PROSPECTS FOR DEVELOPING MALIAN RED MEAT AND LIVESTOCK EXPORTS

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Executive Summary

PROSPECTS FOR DEVELOPING MALIAN LIVESTOCK EXPORTS

The objective of this study is to examine the long term prospects for increasing net economic returns to Mali's livestock trade. The study objective can be divided into four areas of investigation which are characterized by the following questions:

1. What will be the most important sources of ruminant livestock production growth in Mali?
2. What are trends in red meat supply and demand for Mali, and what are the prospects for continuing exports to the regional market?
3. What is the potential to add value in the livestock chain for export?
4. How can public policy increase economic returns from livestock exports for Mali?

This report presents summary findings for each of these questions. These results are based upon component studies that have been prepared by the Malian members of the team.

1. **What will be the most important sources of ruminant livestock production growth in Mali?**

Production growth can come from herd growth or from productivity increases per head. The study evaluated influences on herd growth for six production systems distinguished by agroecological zone and the type of agriculture associated with the system.

The greatest scope for livestock production growth exists in the agropastoral zones both through raising herd numbers and productivity in these regions. This implies that public efforts to support livestock (including research, or services associated with animal health, nutrition, market development etc.) should concentrate in these zones. A further basis for a shift in emphasis in public services to the livestock sector is the increasing importance of small ruminants in all systems except where dry season water control is available.

Although the expansion of crop area is negatively associated with herd growth for all livestock systems, it is not a significant association in any except systems associated with dry season crops or with long term agricultural development activities. This suggests that in these areas, there is substantial competition between animals and crops for dry season pastures suitable for irrigation or recession cropping, or with labor use in agriculture.

The analysis confirms the impact of drought in shifting herds from pastoral systems associated with dryland crops to systems which have dry season crops due either to irrigation or flood recession. This has implications for investments in water control and for drought response strategies. First, to the extent that dry season agriculture buffers herd losses from other systems during drought, this effect should be factored into the benefits of these systems in assessing public investments. It also suggests that programs targeted to pastoralists during droughts should address this transfer of animals in their strategies.

The study also found weak evidence based upon aggregate data that herd offtake rates and animal weights have both increased over time. Plausible explanations of each are, respectively, the impacts of public animal health interventions in reducing mortality and raising reproduction performance, and the development of seasonal fattening activities to raise animal weights.

2. What are trends in red meat supply and demand for Mali, and what are the prospects for continuing

exports to the regional market?

Projections analyses reconfirms the fact that if past trends in domestic consumption and production of red meat continue, total consumption will overtake production in the next ten years, and Mali will lose earnings from livestock exports. Only raw or tanned hid and skin exports would likely increase under this scenario as local slaughter increases.

On the other hand, the analysis also illustrates two important sets of assumptions which each provide feasible scenarios for sustaining the export market. First, on the supply side, the sensitivity of production growth to biological productivity parameters, and the current low level of some of these parameters in comparison to norms in more developed livestock systems suggest that there is ample room to raise productivity above levels that have persisted in the last thirty years. These changes are most likely to sustain production growth, in the agropastoral systems where feed biomass remains in surplus. Agropastoral systems associated with rainfed cereals or rent crops each have substantial capacity. Livestock systems associated with irrigated crops might also expand rapidly if private investment in irrigation occurs.

Secondly, price changes are likely to depress demand for red meat. This may occur first due to the emergence of cheaper industrially produced poultry within Mali. Moreover, projected increases in the world prices for red meat could further dampen demand for red meat in Mali, and increase consumption of poultry as a substitute. Of course, other uncertain parameters such as the pace of per capita income growth and the rate of urbanization could offset the moderating effects of red meat price increases on domestic red meat demand growth if they increase more rapidly than projected.

Lastly, whether supply or demand changes occur as projected in the domestic market for red meat, could to a large extent be influenced by policy. Improvements in supply due to productivity increases are likely to be associated with investments in improved health, diet, and intensification of production through such activities as fattening. Changes in demand due to world price changes will be automatic as long as policy allows a flow through of price changes from world markets. Finally, the emergence of poultry (or other protein alternatives) may be most rapidly advanced by improving the climate for private investments in new agro-industries.

3. **What is the potential to add value in the livestock chain for export?**

The study evaluates two important ideas for increasing value added in the livestock sector. The first is the prospects for increasing the value of animals through small-scale seasonal fattening, while the second is to move the locus of slaughter to the Mali in order to capture for Mali the value-added in slaughter and animal product and byproduct processing.

a. Fattening

The study documents a dynamic and relatively new sub-sector that is emerging in central and southern Mali to raise value in livestock through short term seasonal fattening. This industry takes advantage of several complementary phenomena:

- thin but healthy animals bought in from more northerly pastoral zones,
- the availability of relatively abundant crop residues
- the expansion of low valued cotton seed cake
- the seasonal unit price increase for animals over the hot dry season
- the proximity to cattle trading routes to southern commercial markets

The prospects for expansion of fattening appear attractive both in financial and economic terms.

Economically, the most competitive enterprises are small farm-based enterprises and sheep enterprises because these typically draw on surplus byproducts of the farm and low-opportunity cost labor. However, the prospects of expanding this activity are limited by the availability of these cheap resources.

Larger commercial fattening operations are also economically attractive, however, and present greater prospects for expanding fattening activities in the long run. Various constraints to growth of the sector identified by the study include: 1) access to protein feed concentrates, particularly cotton seed cake, 2) access to and timely delivery of seasonal financing of fattening, 3) information on prices in source and destination markets, 4) inadequate knowledge or technology to make optimal use of local feed resources in feed rations, and 5) competition with agriculture for access to production factors.

b. Animal slaughter and processing

The analysis of the prospects for increasing value added through domestic slaughter suggests that under current market conditions, livestock exports remain financially more profitable than either carcass or boxed meat exports to the regional market. In fact, both carcass and boxed meat exports show negative profitability in regional markets under policy conditions that pertained through the beginning of 1997.

The good news for increasing value added through slaughter are twofold. First, due to projections of rapid growth in domestic demand for red meat , the slaughter industry and the byproduct industries that depend on it are assured steady growth. Secondly, several policy changes can make the activity much more attractive for development of export markets as well. First, the removal of the tax on raw hides and skins exports this year has already made both carcass and boxed meat exports marginally profitable opportunities in several West African markets, although they are still much less attractive than livestock exports to these markets. This opportunity is made more interesting if Mali can convince its coastal buyers to exempt Malian meat from the tariffs imposed on meat imports from world markets to offset export subsidies provided by these suppliers.

Even more important for increasing profitability in moving fresh and frozen meat product between the Sahel and the coast, however, would be a reduction in transport taxation in coastal countries . An elimination of these taxes would dramatically reduce the costs of moving fresh and frozen product between the Sahel and the coast. This issue is all the more important to the extent that the analysis has not included the costs of illicit taxation in the transport analysis for these products. If illicit taxation is allowed to proliferate in the trade of fresh and frozen meat trade at the same level as it has for livestock, all prospects for a profitable trade disappear.

Another interesting conclusion of the analysis is that there may already be substantial profits in the sale of certain boxed high quality cuts of meat beyond the region such as the Middle East. This opportunity suggests a strategy for developing Mali's slaughter industry that would target these markets first as small scale opportunities to develop the expertise, infrastructure and services to market quality meat products in foreign markets. These developments might then allow cost reductions that would permit Mali to develop emerging markets for higher quality in its traditional coastal West African markets.

Lastly, the analysis also demonstrates the strong detrimental effect which ad-hoc policies to favor specific value-adding industries can have on the general development of a sub-sector. This was the case with respect to the tanning industry in Mali, which sought to protect its access to raw hides and skins exports by obtaining a tax on their export. While this policy reduced raw hide and skin costs to the tanning industry, it also had the negative effect of reducing incentives to domestic slaughter by depressing the value of the hide and skin byproduct. Thus it raised relative incentives to export livestock to the detriment of the domestic slaughter industry. A more evenhanded policy of low taxation for the entire sector will promote investment in the sector, while allowing private actors to determine the most lucrative investments to raise their financial returns, and thereby the sector's economic returns.

4. How can public policy increase economic returns from livestock exports for Mali?

The study identifies a number of policy measures which can contribute to increasing the value of exports from Malian livestock. These can be summarized under three principal challenges: accelerating production to assure an exportable surplus, increasing the efficiency of marketing , and increasing economic value added in processing. Policy initiatives to address each of these challenges are:

a. Accelerating Production

- Government should place increasing emphasis on providing support services (including research, or services associated with animal health, nutrition, market development to livestock etc.) to agropastoral systems, small ruminant production and small scale fattening enterprises.

- Policy measures should be designed to facilitate efficient resource allocation between livestock and competing interests. These could include strengthening markets for resources, and public institutions and rules governing resource allocation conflicts. Particular issues that should be addressed are rights to land use particularly in the dry season, and particularly in lowland and flood recession areas.

- Drought strategies should be prepared to facilitate the process of offtake during drought and reconstitution after drought. These should target dryland pastoral zones where drought has been shown to have the largest negative impact, and areas such as the Office du Niger and the Delta du Niger regions which absorb animals during drought due to the availability of dry season feed biomass. Reconstitution strategies after drought should target the same zones in the reverse process. Drought policies should also be designed to facilitate animal movement and access of pastoralists to emergency resources. Government efforts to "program" destocking or reconstitution with measures that limit when, what kinds or how many animals may be exported during these periods of crisis are counterproductive and should be avoided. They only increase uncertainty, impede market performance, and reduce opportunities for livestock producers to mitigate risk.

- Fattening activities in agricultural zones should be another focus of new private investments. Policies to address constraints faced by fattening enterprises can foster these investments.
    - support to private banks to service fattening enterprise clients;
    - support to services providing extension advice on optimal feed rations and use of domestic feed sources;
    - removal of all official restrictions on the market for cotton seed cake.

b. Increasing the Efficiency of Marketing

- Monitor national agents of customs, police, military and veterinary inspection services to eliminate unauthorized taxation of livestock trade;

- Sponsor dialogue among market actors and officials in Mali and in destination countries to sustain progress to reduce high costs associated with unauthorized taxation by the same services in coastal countries;

- Disseminate information to livestock traders on prices, marketing opportunities, and changes in official trade regulations in coastal countries;

- Reduce taxation of road transport which is currently applied through taxes on purchase of vehicles and spare parts and taxes on fuel;

- Eliminate restrictions on truck movements across borders based on nationality of registration;

- Liberalize air freight services out of Mali to increase competition, lower costs and improve availability and service. In particular, Air Afrique's privileged contract should be renegotiated to encourage competitors.

- Increase capacity of the Bamako-Dakar railway to transport live animals and containers. While costs of exporting by rail appear to be substantially cheaper, there appears to be a capacity constraint to use of the railroad for livestock product exports (both for live animals and for containers for either hides and skins or refrigerated product).

c. Increase Value Added in the Livestock Processing

- Introduce investment incentives to encourage private investors to establish slaughter house facilities, regardless of scale, which meet international standards.

- Avoid large direct investments of public resources to promote regional red meat exports since such investments are not likely to be financially attractive.

- Assist private operators to obtain training to meet grades and standards required for meat products for international markets targeted by these operators.

- Assure adequate inspection of meat processing firms to assure that standards are correctly applied.

- Maintain an evenhanded export taxation policy for all livestock products which maintains taxation levels at zero or low levels for all products in order to avoid bias in investment incentives between value adding sectors.

Chapter I

INTRODUCTION

The livestock sector accounts for approximately one fifth of Mali's GDP and is the second most important agricultural export. In addition, it is the principal source of livelihood for nearly 30% of the population. However, over the past two decades, livestock's contribution to Mali's economic growth gradually shrank, in large part due to policy induced biases against the sector. The elimination of export taxes in 1993 and the devaluation of the CFA franc in 1994 largely corrected this bias and, with renewed incentives to export, livestock trade increased dramatically over the past three years. Other changes which have improved prospects for the sector include a concerted public effort to liberalize regional livestock trade controls with Cote d'Ivoire and Ghana .

With the revitalization of livestock exports, a number of important questions have emerged as to how livestock trade will develop and what the public role in this development should be in the sector. First of all, given past stagnation in herd growth and productivity per head, it is not clear where additional supply will come from. While most product growth has come from increasing herd numbers in the past, growing pressure on range land and increasing use of crop residues severely limits this opportunity. On the other hand, until now, productivity per head has not increased because techniques to do so have remained financially unattractive. However, relative price changes induced by the recent devaluation.

Despite considerable public efforts to enter into the livestock trade in the past, Mali's livestock sector remains largely a private and often "informal" sector activity. All of Mali's livestock exports are on the hoof, while domestically consumed meat is sold with almost no processing beyond slaughter and little product differentiation. The emergence of demand for more sophisticated products will test the ability of this "traditional" sector to respond to these opportunities. In particular, regulations of potential trade partners requiring strict health/sanitary control, substantial infrastructural investments, and formal institutional arrangements pose important challenges for the sector. Policies to promote private investment in the sector and to provide a regulatory framework for trade which conforms to international standards might allow the sector to "formalize" without loosing its robust private character.

Lastly, unlike many primary commodity exports of West Africa, whose ultimate consumers are in western markets, livestock products have been largely destined for regional African markets. This regional trade's exposure to world markets has been protected by the border policies of coastal African states. At the same time, very porous internal borders have limited the effectiveness of regional livestock trade controls. These factors have meant that the fortunes of Sahelian exports have been influenced principally by the policies of consuming coastal countries with respect to world markets, rather than by policies governing trade within the region. An important issue, therefore, is how border policies might be coordinated in the future in order to maintain a stable regional market.

The objective of this study is to examine the long term prospects for increasing net economic returns to Mali's livestock trade. The study objective can be divided into four areas of investigation which are characterized by the following questions:

1. What will be the most important sources of ruminant livestock production growth in Mali?
2. What are trends in red meat supply and demand for Mali, and what are the prospects for continuing exports to the regional market?
3. What is the potential to add value in the livestock chain for export?

4. How can public policy increase economic returns from livestock exports for Mali?

This report presents summary findings for each of these questions. These results are based upon component studies that have been prepared by the Malian members of the team. The correspondence of these component studies to the questions raised above, is as follows:

Abou Doumbia conducted the analyses of livestock systems production trends and projections of supply and demand. His analysis forms the basis for the results drawn by this report in response to questions 1 and 2, above. The projections analysis also draws from the Marketing and Fattening analyses.

N'thio Alpha Diarra conducted an analysis of the prospects for increasing value added through fattening operations in agropastoral systems in Mali. This analysis represents one component of the response to question 3.

Lamisa Diakite undertook analyses of market chains and of value added in these chains for livestock, fresh meat and hides and skins. His analysis provides the basis for the analysis of value added in livestock marketing, which provides a second part of the response to question three.

Jeff Metzel prepared this document which synthesizes and extends the analysis prepared by each of the contributing authors to the study. Some conclusions to this report differ substantially from those of the individual authors because of changes in assumptions which resulted from the individual analyses. These changes are not reflected in the separate consultant reports because of the chronology of their completion.

The remaining chapters (Chapters II through VI) of this report respond to the four questions posed above. Chapter II examines trends in livestock production and develops a model to explain herd growth in six sub-systems of ruminant production. Chapter III develops projections for red meat and examines their sensitivity to important variables. Chapters IV and V address the issue of adding value to livestock exports. Chapter IV examines the prospects for animal fattening, while Chapter V evaluates the case for value added in slaughter and processing red meat. Finally Chapter VI presents a policy agenda based on the findings of the previous analyses. Annexes A, B and C provide supporting tables for the analyses presented in Chapters III, IV and V, respectively.

Chapter 2

TRENDS AND CAUSES OF RUMINANT LIVESTOCK PRODUCTION GROWTH IN MALI

Production growth can come from herd growth or from productivity increases per head. Trends in both of these dimensions are examined in this chapter in order to evaluate the future of livestock production and export trade in Mali The analysis attempted to disaggregate production trends by production system in Mali, and then to seek explanations for these trends.

Livestock System Definitions

Production system definitions used by the study were based upon classifications that have been defined by the national livestock department.[1] These definitions identify systems with specific agroecological zones of the country and with the type and importance of agriculture practiced in each zone. Thus systems are distinguished between *pastoral* and *agropastoral* systems according to whether most rural producers in the zone derive their income primarily from livestock or agriculture, respectively. This distinction is of course strongly associated with rainfall levels. Agricultural systems are further differentiated between rainfed agriculture and two systems which have some form of dry season cropping, irrigated either on irrigated or flood recession land. Finally, in the agropastoral zone, a distinction is also made between zones in which agriculture is primarily cereal based and those where cash crops, particularly cotton but historically also peanuts, are the principal crop. Defining characteristics of these six systems are presented in Table 2.1.

Table 2.1
Characteristics Of Malian Ruminant Herd Systems

System Name	Livestock management	Crops	Climate (rainfall, mm)	Principal Regions
1. Pure pastoral	transhumant, pastoral	stream bed gardening	arid (< 300 mm)	Gao Timbuctou
2.Pastoral/ rainfed crops	transhumant, pastoral	rainfed cereals millet/sorghum	semiarid (300-500 mm)	Northern Kayes, Koulikoro, Mopti
3. Pastoral/ flood recession crops	transhumant, pastoral	sorghum/ rice	semiarid (300-500 mm)	Mopti: (Niger Delta) Kayes: (Senegal Valley)
4. Agropastoral/ rainfed crops	semi-sedentary	millet sorghum, cowpeas	semi-arid - subhumid (500-800 mm)	Southern Kayes, Koulikoro Segou,
5. Agropastoral / Irrigated crops	semi-sedentary	rice	semiarid (500-800 mm)	Segou (Office du Niger)
6. Agropastoral / cash crops	sedentary	cotton, peanuts and rainfed cereals	subhumid (800-1500 mm)	Sikasso

[1] See Doumbia (1997) and Maiga and Doumbia (1994) for a more complete description of each production system.

Trends in herd size were distinguished for these six production systems by first assigning all *cercle* (counties) in Mali to one of these systems. *Cercle* level data on herd size has been maintained separately for cattle and small ruminants since 1965, based primarily on vaccination campaign statistics.[2] The resultant herd series therefore provide total herd numbers by species and year for particular geographic areas which have been assigned to a particular production system for the entire period of the analysis.

Trend Analysis of Herd Growth

Tables 2.2 and 2.3 present herd size and growth rates for each of the six pastoral and agropastoral systems in Mali since the mid-1960's.

[2] Annexes of the Doumbia (1997) report presents these data and corrections that were made to them for this study.

Table 2.2
Past and Current Herd Size by Production System

	Initial: 1965 -1969 (thousand head)		*Current: 1991-95 (thousand head)*		*Percent Current of Initial Size*	
	Cattle	***Small Ruminants***	***Cattle***	***Small Ruminants***	***Cattle***	***Small Ruminants***
1. Pure pastoral	1777	5843	593.4	3950	33%	68%
2. Pastoral/ Rainfed	812	1223	701	1818	86%	149%
3. Pastoral/ Flood recession	696.6	1528	755	1423	108%	93%
4. Agropastoral/Rainfed	1070	1380	1510	3242	141%	235%
5. Agropastoral/ Irrigation	130.6	224.6	161.8	240.4	124%	107%
6. Agropastoral/Rent crops	636.6	441.6	1672	1332	263%	302%
National average	**5122**	**10640**	**5393**	**12006**	**105%**	**113%**

Table 2.3
Long Term and Recent Herd Growth Rates by Production System

	Long term (1962-1995)		*Recent (1986-1995)*	
	Cattle	*Small Ruminants*	*Cattle*	*Small Ruminants*
1. Pure pastoral	- 4.25 %	-1.83 %	4.14 %	2.27 %
2. Pastoral/ Rainfed	- 0.93 %	1.34 %	2.74 %	2.94 %
3. Pastoral/ Flood recession	- 0.02 %	-0.56 %	1.07 %	1.11 %
4. Agropastoral/Rainfed	1.48 %	3.21 %	4.07 %	3.25 %
5. Agropastoral/ Irrigation	0.95 %	0.00 %	0.56 %	1.73 %
6. Agropastoral/Rent crops	3.91 %	4.25 %	2.11 %	3.92 %
National average	**0.20 %**	**0.26 %**	**2.70 %**	**2.63 %**

The results of Tables 2.1 and 2.2 illustrate clearly a number of important trends. First, long term growth of pastoral systems has been stagnant or negative, while agropastoral systems has been positive. This has resulted in an underlying shift in herd distribution toward the latter systems. The impact of two severe droughts during the last thirty years is most evident in pastoral systems without access to recession crop areas. As a result, at a national level, herd size has stagnated in the long run despite moderate herd growth in the past decade. In effect growth in the past decade has merely returned the national herd to levels which were present thirty years ago.

These long run trends are generally shared by both cattle and small ruminants. A second trend, however, is the gradual substitution of small ruminants for cattle in most systems. This is most evident in pastoral herds associated with dryland crops (Sys. 2) where cattle numbers have declined in the long run while there has been modest growth for small ruminants. In pure pastoralism, both cattle and small ruminant numbers have declined, but the decline for small ruminant numbers has been much less marked. In agropastoral rainfed crop zones (Systems 4 and 6) both cattle and small ruminant numbers have grown in the long term, but the latter have grown much more rapidly. Rates of herd growth are higher for cattle only in systems associated with some water control (Sys. 3 and 5).

In the past decade, growth in pastoral systems has been rapid as these herds have regained their previous numbers. This growth is not likely to continue, however, if past patterns are repeated. These patterns suggest that a plateau is reached in these systems above which further expansion does not occur. This is thought to reflect a carrying capacity constraint due to feed biomass limits (de Leew et.al., 1991). [3] On the other hand, underlying steady growth in agropastoral systems has continued and does not appear to be constrained by carrying capacity.

Finally, systems associated with flood recession and irrigated agriculture have shown the slowest growth in recent years. This may be explained by the fact that water control in agriculture the presence of dry season pastures mitigated destocking during drought periods for these systems. Thus they have remained closer to resource capacity and so have had little room for additional growth in recent years.

Exogenous Effects on Livestock Production

To understand better how livestock production is likely to evolve in Mali, the study attempted to identify important reasons for the trends identified in the previous section. The component study by Doumbia (1997) identifies six important influences on production systems in Mali in the recent past. These are rainfall, drought, human population growth, agricultural area expansion, agricultural intensification, and market price. Rainfall and drought are obviously related to each other and are exogenous to herd size (at least in the time horizon of the analysis). The other influences may not be exogenous to livestock development in the long run, but each embraces a much larger set of influences than the livestock subsector alone. Each of these influences on livestock production is discussed below, and then an econometric model is developed and evaluated to test their influence on herd growth trends.

Rainfall and drought.

Range biomass is known to be closely linked to effective rainfall levels, although modeling this relationship is complicated by the high spatial and temporal variability in rainfall patterns from year to year. Herd carrying capacity is understood to be constrained by range biomass, although in years in which stocking rates are well below carrying capacity , this constraint may not operate, thereby weakening correlations between biomass and herd size. On the other hand, herd numbers within arid zones of the Sahel adjust rapidly to biomass availability through transhumance, such that some positive correlation between biomass (and therefore rainfall) and herd size is expected to exist even in non-constraining years. Greater availability of feed biomass in good rainfall years should also increase the correlation between rainfall and herd growth rates through the impact of feed availability on better nutrition on animal reproduction, morbidity and mortality. In more southern, higher rainfall zones, however, the significance of the correlation of herd size to rainfall is expected to be weaker or nonexistent due to the weaker constraint of carrying capacity on herd numbers and the increased impact of other factors on morbidity and mortality.

Drought, a condition of severe and widespread rainfall deficit, is assessed separately from rainfall on the assumption that it disrupts not only animal performance but the entire pattern of production. Thus while

[3] P.N de Leew et al. “An analysis of Feed Demand and Supply for Pastoral Livestock in the Gourma Region of Mali” ILLA, Bamako, Mali. 1991(?).

rainfall will be correlated with changes in herd productivity, drought is expected to result in changes in species mix of herds, migration between production systems, and structural changes in herd ownership; and therefore management patterns to allow production units to survive.

Drought has hit Mali twice in the past thirty years, first in 1973, and again in 1984. Both droughts had a particularly strong negative impact in arid pastoral zones, causing a severe shortage of biomass and resulting in a loss of nearly half of all ruminants through moralities and /or distress sales. An exception to this dramatic reduction in numbers was in pastoral zones where dry season biomass was available from flood recession pastures. In less arid, and therefore increasingly agricultural systems, the impact of drought on herd numbers has also been weaker, in part because droughts have a less pronounced effect on biomass availability, in part because losses from drought were to a large extent compensated for by animals migrating from harder hit pastoral zones, and in part because the family economy of livestock produces was more diversified, allowing them to reduce distress sales of livestock.

Demographics and agricultural extensification and intensification

The sheer necessity of absorbing more people in the rural sector is driving change in Malian agriculture and livestock sectors. Natural population growth has been and is likely to remain strongly positive for the next fifteen years. It is estimated to be between 2.1 and 2.4% per year currently.[4] However, substantial differences exist within the country. Net growth in Bamako and secondary regional urban centers is estimated at over 5% while for rural areas the average is closer to 1.5%. This differential is explained largely by rural-urban migration since natural growth rates are nearly identical in rural and urban areas. Moreover, surveys by the CERPOD project has found important trends in inter-regional migration which show a movement out of pastoral zones and towards agricultural zones in the south.

Given population growth, there are two alternatives for raising crop income to sustain rising rural populations: cultivated area can be expanded (extensification), or yields per unit of land can be raised by additions of other inputs (intensification). Extensification is already limited in the Sahel to increasingly marginal lands, which are characterized by poorer soil quality, lower rainfall and therefore declining yields. In sub humid zones, arable land remains available, but at increasing distances from urban markets. Moreover, as the best soils are occupied, farmers must begin to cultivate less desirable soils. In many areas these soils are the heavier clay soils in low land areas which require greater labor investments to cultivate. This trend generates, in turn, an increase in the use of animal or mechanical traction to supplement manual cultivation practices. Lastly, to the extent that isolation from markets is the principal constraint to the profitability of crop production, better transport infrastructure can reduce access costs to isolated rural areas and therefore promote crop extensification. This applies in all areas, but is particularly constraining in sub-humid zones, where land transport is made more difficult during much of the year by heavy rains.

Animal productivity may be expected to correlate negatively with agricultural land expansion in systems in which land is occupied by crops during seasons in which biomass is constraining for animals. The negative condition may be less significant in the case in rainfed cereal systems because biomass constraints are binding only in the hot dry season (March-May), when no crops are being cultivated. Because animals are typically allowed to graze crop residues, the biomass tradeoff in these systems is largely reflected by differences between the biomass value of crop field residues and of range land during the dry season. Most importantly, in flood recession and irrigated crop systems (systems 3 and 5), there is likely to be a displacement of valuable lowland dry season pastures with crop land, and therefore a negative correlation between crop area expansion and

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[4] The lower statistic is that of the Ministry of Plan based upon the last census, while the latter is the current estimate of the CERPOD/CILSS project based upon recent survey data.

livestock production.

Independently of the impact of agricultural land expansion , however, animals numbers may be expected to be positively influenced by rural population growth due to the desire of rural households to possess their own animals. In addition to the convenience and economy of own-production for consumption of milk and meat, animal ownership fulfills numerous social/cultural obligations (e.g. marriage, religious celebrations, etc.). Of course, there is reverse causality in the link between animal herd growth and human population growth to the extent that human livelihood in some regions is dependent on livestock. This is, by definition, the case for pastoral systems, for example.

These hypotheses suggest that human population growth and agricultural land expansion are likely to be highly correlated but may have opposing effects on livestock herd growth. Unfortunately for this study, independent series data was not found on population growth associated with livestock production systems, thus population growth *per se* is not introduced into the econometric model developed below. In the absence of a control for population growth, the association of animal numbers to agricultural extensification is therefore ambiguous in most livestock systems, although in areas with dryseason cropping, the most likely negative impact of crop area expansion is expected.

Intensification is most easily accomplished in the Sahel by increasing labor use and nutrient application. In areas where intensification is the dominant contributor to production growth, the expected correlation to livestock production is unclear. Labor use in agriculture increases with agricultural intensification in the Sahel due to greater use of labor in land preparation and seeding. These demands compete with livestock raising requirements for labor in pastoral and agropastoral systems because the need for round-the-clock animal husbandry to keep animals out of crop fields during the crop season conflict with demands for crop preparation. To address this conflict, various management arrangements have emerged in villages to consolidate herds and to move herds away from producing areas during the crop season. On this basis, there may be a negative impact of agricutlural intensification on livestock numbers.

On the other hand, crop intensification may also have positive spill-over effects to livestock, such as increased availability of inputs, better transport/market infrastructure, better information, and increased access to credit. In Mali, this is expected to be the case in Systems 5 and 6 in which development initiatives have provided these inputs/services to agriculture. System 5 represents the Office du Niger, where government and donor efforts have focused on intensifying rice production. System 6 represents the cotton zone which has been the beneficiary of the Compagnie Malien de Developpement des Textiles (CMDT) investments to raise cotton production. Both the Office and the CMDT have had well funded livestock components included in their development programs. For this reason, *a priori*, the impact of intensification in these zones is expected to be positive. In other systems, the impact of crop intensification is unclear. Particularly where intensification has occurred of necessity to raise returns on increasingly scarce arable land, the impact may be negative to animal numbers because of the likely competition for scarce land, labor and capital resources.

Livestock Price

In addition to these influences, a final influence that is incorporated into the model below is the price of livestock. However, the impact of livestock price changes on herd size is ambiguous. Classical micro-economic theory would predict that as livestock prices rise, producers will sell more animals to take advantage of the price rise, thus reducing herd numbers. On the other hand, to the extent that there is an expectation that prices will remain high, herders may choose to reduce offtake of reproductive stock in order to increase herd reproductive capacity, and thereby raise animal sales in the future, this response may create an “adverse” supply response in the short run.   Thus, if real prices are expected to rise in the long term, there should be a positive correlation between herd size and price.   The adverse price effect should be evident in systems which concentrate on reproduction as compared to systems that concentrate on growing out or fattening animals, since the adverse effect operates on reproductive cattle. To a limited extent, the former is more characteristic of pastoral systems while the latter is more characteristic of agropastoral systems.

Over the period of the investigation, real livestock price trends were influenced by a number of phenomena which changed the relative price of red meat in the region. After the drought of 1973, Sahelian supply was depleted so the coastal countries of West Africa began to import from world markets in order to hold down consumer prices.   In the late seventies and early eighties, the European Community increased subsidies of livestock meat exports, thus depressing these exports on world markets. Finally, the CFA became increasingly overvalued starting in 1985 through 1994, further depressing prices expressed in CFA.

Projections of demand and supply trends presented in Chapter III suggest that excess demand and therefore imports from world markets will continue for West Africa as a whole in the foreseeable future. These trends legitimate the assumption that the price of red meat in Mali will continue to be set by coastal country market imports, which will in turn continue to be set in reference to world market imports.

Summary of Expected Influences on Herd Size

A summary of these hypothesized relationships between livestock numbers in each system and these “exogenous” influences is presented in Table 2.4. The table reports the expected impact on animal herd numbers of an increase in the variable indicated. Thus an increase in rainfall is expected to have a positive impact on herd size in all systems, but particularly in systems 1, 2 and 4, while drought is expected to have strong negative impact on herd numbers in systems 1 and 2, a weaker negative impact in 4 and 6, and positive impacts in 3 and 5.

Population growth is expected to result in increasing heard growth in all systems, but particularly in agropastoral systems because of faster growth in these areas. Agricultural extensification independent of the effects of rural population growth is expected to have a negative impact on livestock numbers in all systems, but particularly in systems 3 and 5 due to competition for dryseason land.   Assuming no independent control for rural population is made, the impact of agricultural extensification is ambiguous in most systems but, may be more negative in systems 3 and 5 due to the competition effect, but more positive in 4 and 6 due to the demographic effect.   Intensification is hypothesized to have little effect on most systems but perhaps a positive effect on Systems 5 and 6 due to the relatively strong effort to expand services to agriculture in these systems.

Table 2.4
Exogenous Impact on Changes in System Specific Herd Size

System:	Pure pastoral 1	Pastoral/ rainfed crops 2	Pastoral/ flood recession 3	Agropastoral / rainfed 4	Agropastoral / irrigated 5	Agro-pastoral/ ca crops 6
Effect of increase in:						
Agroclimatic						
Rainfall	++	++	+	++	+	+
Drought	- -	- -	+	-	+	-
Population	+	+	+	++	+	++
Agricultural change						
extensification w/o pop. effects	-	-	--	-	--	-
extensification w/ pop. Effects	?	?	?-	?+	?-	?+
intensification	-	-	-	-	+	+

A Model of Influences on Livestock Herd Size in Mali

A model to explain changes in herd size by system is proposed to investigate these proposed influences in detail. Population is excluded from the model due to the lack of system specific data. However, as noted above, agricultural extensification may serve as a proxy for population growth in some areas. Time and therefore trend may also be associated with population growth.

The model is based on the identity of herd growth (the change in herd size) to herd biological growth and herd offtake (equation 1).

$$dH= H^{(t)} - H^{(t-1)} = B^{(t)} - O^{(t)} = (X^{(t)} - M^{(t)}) - O^{(t)} \tag{1}$$

where: H = herd size; X = herd reproduction
B = Biological herd growth; M = herd mortality
O = Herd offtake

Herd biological growth defined as the net gain in herd size from live births less moralities in a given time interval, while

Herd biological growth

Herd biological growth is expected to be a function of rainfall (R), drought (D) and the rates of agricultural extensification (E) and intensification (R). As noted in the discussion above, all four variables are important in determining the availability of biomass, while the latter two also are expected to correlate with the degree of competition for other resources, including labor, capital, and tradeable inputs to production. The herd biological growth equation is thus:

$B^{(t)} = f(R^{(t)}, D^{(t-1)} E^{(t-1)}, I^{(t)})$

Herd offtake

Herd offtake represents all management decisions to remove animals from the herd and covers purchases, sales and social exchanges through gifts, thefts and loans of animals outside the herd system. Social exchanges are thought to neutralize between exchanges into and out of the herd, and so are ignored. Herd offtake can therefore be simplified to net sales (sales - purchases), and so be represented by a supply function. The offtake equation is expressed as a function of price and last year's herd size.

$O^{(t)} = f(H^{(t-1)}, P^{(t)}_{l,})$

where:

P = the real price of red meat
t = time

Last year's herd size is included as a proxy for the stock of marketable animals (inventory). The analysis evaluates price as an exogenous variable which is not influenced by changes in Mali's supply.

Change in herd size

Based upon the assumptions noted above, the behavioral equation for changes in herd size estimated by the econometric analysis is.

$dH = f\ (H^{(t-1)}, P^{(t)}, R^{(t)}, D^{(t-1)} E^{(t-1)}, I^{(t)})$

All of these independent variables are assumed to be exogenous to changes in herd size. This is potentially a dubious assumption with regards to price if price equilibrates supply and demand. However, price assumed to be exogenous because it is determined in consuming coastal markets by world market prices, since these markets are net importers from world markets. This hypothesis is buttressed by examination of trade trends of Mali's principal export partner, Cote d'Ivoire, which illustrate clearly that it has imported both from Mali and from world markets during the period of the analysis.

The Data

Although data limitations have restricted the testing of hypotheses noted above, a number of relationships can be tested with the information collected by Doumbia for this study. These data are summarized here. They are explained in detail in the annex to his report.

- **Rainfall**: Doumbia's research provides time series estimates of rainfall for 6 rainfall stations throughout Mali. However, due to the high variability of rainfall in time and space in the Sahel, individual point estimates for each agroecological zone were considered insufficient. Therefore, a single average of point estimates for three pastoral cites was taken to reflect rainfall for all pastoral systems. Similarly a single annual average for all agropastoral zones based on three measurements was used for the three agropastoral systems.

- **Drought** is measured as any year in which rainfall fell below 1.5 standard deviation from the mean in the pastoral zone.

- **Agricultural extensification** is an index of the change in field crop area (field crop data used for this measure included the sum of millet, sorghum, maize, peanut, and cotton area). These were converted to an index of change in area because of the vast differences in area between systems, and to adjust for the presence of a unit root in the data.

- **Agricultural intensification** is measured by a production weighted average annual cereal yield not explainable by rainfall. Thus the residual of a regression of cereal yields on rainfall was used to represent this variable.

- **Price** The price (constant 1996) of beef in Abidjan is used in the analysis as the reference price for livestock in Mali.

Model Results

The results of pooled OLS regressions for all systems combined allowing only for a system specific intercepts are presented in the first equation in Table 2.5. The results suggest that globally, herd growth is positively correlated to rainfall, and negatively correlated to herd size, drought and crop extensification in the previous year, meat prices, and crop intensification. All of the coefficients are significant at least at the 15% level except crop extensification. These results support the expectations of the hypotheses noted above with respect to herd size, price, and rainfall for all systems, and with drought, extensification and intensification for pastoral and rainfed systems. Tests of co-integration were not possible on the pooled cross section data, although the same equations run for individual systems found that the resultant equations were valid. Although the significance of the equation is high (F statistic = 8.5), the explanatory power of the equation is relatively low (ajdusted R^2 = 0.16). To understand better, however, how the various variables affect production systems, system specific effects are examined below.

Table 2.5
Explanatory Variables for Growth of Malian Livestock Systems
Dependent variable: Change in Herd Size

	Variables:	*Herd size last year*			*Price of red meat*			*Rainfall*			*Drought dmy (last yr)*			*Crop Area change*			*Crop Intensification*		
	System	***coeff.***	*std. error*		***coeff.***	*std. Error*		***coeff.***	*std. error*		***coeff.***	*std. error*		***coeff.***	*std. error*		***coeff.***	*std. error*	
I.	**Global (Sys. 1-6)**	***-0.112***	*0.030*	**	***-0.134***	*0.070*	*	***0.288***	*0.110*	**	***-56.504***	*31.692*	*	***-26.190***	*20.548*		***-34.372***	*23.108*	~
II.a	**Pastoral (Sys 1-3)**	***-0.174***	*0.050*	**	***-0.190***	*0.139*		***0.993***	*0.356*	**	***-88.365***	*57.352*	~	***-38.795***	*30.064*		***-126.487***	*80.381*	~
II.b	**Agropastoral (Sys 4-6)**	***0.012***	*0.031*		***-0.030***	*0.055*		***0.233***	*0.063*	**	***-21.196***	*23.036*		***-14.060***	*23.129*		***-0.283***	*13.931*	
III.a	**Livestock w/ rainfed agric. (Sys 1,2,4,6)**	***-0.114***	*0.037*	**	***-0.180***	*0.101*	*	***0.391***	*0.159*	**	***-86.762***	*46.040*	*	***-29.731***	*35.771*		***-38.955***	*36.427*	
III.b	**Livestock w/ water control agric. (Sys 3,5)**	***-0.300***	*0.107*	**	***0.045***	*0.048*		***0.045***	*0.061*		***13.675***	*17.060*		***-18.477***	*8.825*	**	***1.599***	*11.756*	
VI.a	**Livestock w/o AII (1,2,3,4)**	***-0.150***	*0.041*	**	***-0.183***	*0.103*	*	***0.578***	*0.193*	**	***-96.097***	*45.468*	**	***-41.260***	*26.262*	~	***-105.5***	*54.541*	*
VI.b	**Livestock with AII (Sys 5,6)**	***0.240***	*0.017*		***0.052***	*0.031*	*	***0.117***	*0.034*	**	***3.159***	*12.856*		***-18.972***	*11.872*	~	***9.997***	*7.077*	

Note: Confidence intervals: ** = sig at 95%; ** = sig. at 90% ; ~ = sig at 85% AII = Long term agricultural intensification initiatives.

Table 1 (cont.)

	Variables	*System Constants*									
Equ'n	**System**	*1*	2	3	4	5	6	***Adj. R***	***F stat***	***DW***	***n***
I.	**Global (Sys. 1-6)**	**201**	**199**	**197**	**174**	**2**	**172**	0.161	8.506	1.785	156
II.a	**Pastoral (Sys 1-3)**	**127**	**95**	**95**				0.228	6.324	1.895	78
II.b	**Agropastoral (Sys 4-6)**				**-116**	**-128**	**-97**	0.175	5.127	1.478	78
III.a	**Livestock w/ rainfed agric. (Sys 1,2,4,6)**	**233**	**231**		**168**		**165**	0.185	6.855	1.825	104
III.b	**Livestock w/ water control agric. (Sys 3,5)**			**215**		**-37**		0.160	3.384	1.855	52
IB.a	**Livestock w/o AII (Sys 1,2,3,4)**	**226**	**207**	**204**	**92**			0.223	8.367	1.883	109
IV.b	**Livestock w/ AII (Sys 5,6)**					**--159**	**-141**	0.436	9.897	1.790	56

Pastoral/agropastoral distinctions

When comparisons are made between pastoral and agropastoral systems (Equations II a and b), signs change from the overall case for previous year's herd size only, with agropastoral systems showing a positive (but highly insignificant) relationship between previous year's herd size and current change in herd size. The shift of sign suggests that offtake (which has a negative effect on herd size changes) has not been a positive function of herd sizes in agropastoral zones. A plausible explanation is that the steady growth of agropastoral systems due to immigration from pastoral zones has masked any decline which a stable herd would show after an increase in offtake rates. It may also indicate the increased capacity of agropastoral zones to absorb inter-annual increases in herds from year to year, without the necessity of increasing offtake to avoid over burdening carrying capacity.

Other important differences between pastoral and agropastoral systems are with respect to the magnitudes of impacts. Thus pastoral systems are much more responsive to price, rainfall, drought, crop area extension and crop intensification than agropastoral systems. These findings again suggest the much more robust character of agropastoral systems with respect to other influences. This is likely to be because of the much greater constraints on pastoral systems which require them to adjust immediately to changes in the natural or market environment.

Differences between livestock systems associated with rainfed agriculture and with water control agriculture

Coefficients for price, drought and intensification change signs for systems associated with water control in comparison to rainfed systems (Equations III a and b). These results suggest the importance of water control to livestock management. The inverse reaction to drought is easily explained to be the impact of in-migration of transhumant herds to water control crop zones from rainfed crop zones to take advantage of the dry season biomass that flood recession pastures or crop residues of dry season flood recession or irrigated crops provide. The positive effect of crop intensification on livestock numbers in these systems may also reflect the relative importance of development initiatives on agriculture, particularly in the Office du Niger. Lastly the "perverse" price response, (a positive correlation to herd size change and a negative correlation to supply) suggests that in these systems, farmers are more quick to adopt herd investment strategies in response to price increases in order to build production capacity. This strategy may reflect a lower discount rate due to the more secure environment in which they can raise livestock.

Presence or absence of agricultural intensification investments (AII)

Equations IVa and b examine the effect of concerted agricultural intensification efforts (AII) on livestock herds. As is noted above, system 5 is integrally linked to the large Office du Niger rice irrigation development efforts, while system 6 is closely tied to the CMDT cotton production zone. All other zones are assumed not to have large and consistent AII efforts. The equations support the hypothesis that AII efforts have positive spillover effects for livestock as well. The coefficient for crop intensification is strongly negative and significant at the 95% level in non AII zones (IV.a), and positive and significant at the 84% level in zones with consistent AII (IV.b). The relatively good fit of both equations in general, in comparison to the other equations also suggests that the characteristic of presence or absence of AII efforts over the long run, perhaps due to the investments that these efforts make, are important in influencing livestock production. Part of the goodness of fit in these equations is due to the fact that the price variable is also uncharacteristically significant in comparison to the other equations. This suggests that livestock producers in these zones are more responsive to market signals, perhaps due to the complementary efforts by AII actors in developing market institutions or improving market infrastructure.

Livestock Productivity Changes

Evaluation of changing productivity in the livestock sector is very difficult due to a lack of useful data. In particular, at the system level, no systematic data is available to suggest changes in natural herd demographic parameters (mortality or fertility rates) nor changes in animal weights. However, weak evidence was found with respect to two non-system specific parameters of productivity to suggest that there have been some improvement.

Herd offtake rates

First, ratios of total exports to total herd size at the national level suggest that the national offtake rate for both cattle and small ruminants has risen substantially over the past thirty years. For cattle, the offtake rate has increased from 9% to 14% over this interval, representing an annual percentage increase in the offtake **rate** of about 1.9 % annually.[5] Similarly, for small ruminants, the national offtake rate has increased from 26% to 36% over the past thirty years, reflecting a 1.2% annual increase in the rate. These fundamental changes in herd demographic behavior suggest that herd productivity has increased to allow higher offtake rates to be sustainable.

An obvious critique of these results is that they are an artifact of poor data. These data are derived from totals of herd size and offtake based upon adjustments to recorded numbers to account for unrecorded stock and exports, respectively. If systematic biases have been introduced into these estimating procedures such a trend would result. For example, increasing offtake rates could simply reflect an improvement in coverage rate of official slaughter or of official export statistic rather than any real increase in these numbers. However, given the magnitude of the change in the offtake rate, it is still instructive to seek real factors that may explain such changes.

One cause of increasing productivity could simply be a shift in animal numbers towards production systems which have higher natural offtake rates. In particular, the shift in numbers towards agropastoral systems could increase offtake rates if these systems have higher offtake rates. To assess this possibility, offtake rate changes were simulated using herd biological growth parameters (reproductive and mortality rates) for system specific cattle herd models. These results were weighted by system herd sizes over the past thirty years and then an aggregate offtake rate was computed. The analysis suggest that indeed shifts in the distribution of cattle toward agropastoral systems explains about a 1 percentage point increase in global offtake rates over the 30 year period, assuming system specific rates have remained constant. However, the remaining 4% of the change in offtake rates for cattle must be accounted for by other factors.

One explanation may be state investments to improve animal health. Since independence,

[5] See component study by Doumbia, 1997.

Mali has maintained a relatively steady effort to vaccinate its herd against the major diseases which threaten cattle and small ruminants. These include rinderpest, foot and mouth disease, and the pluripneumonias. The cumulative effect of reducing the incidence of these diseases would obviously be to reduce animal mortalities, and raise reproductive rates. If the offtake rate improvements are more than systematic bias in data estimations, they may reflect the benefit of these public health campaigns.

Even if the offtake rate increases are real, however, they need not infer increasing productivity if increasing offtake has been at the expense of removing increasingly young and therefore smaller animals. This possibility is contradicted, however by the second evidence of increasing productivity, which are animal weights.

Animal weights at offtake

Animal weights were evaluated by examining animal carcass weights based upon series of weight measurements which were recorded for five abattoirs (Bamako, Mopti, Sikasso, Kayes, and Gao) since the mid 1970s (Doumbia, 1997). None of these series showed a downward trend in carcass weights at slaughter over time. Interestingly, the Bamako slaughter data display a clear opposite trend towards substantially increasing animal carcass weights over a thirty year time interval. Since other regions do not show this same trend, the results appear to reflect a particular demand on the part of Bamako consumers for fattened beef rather than a general trend for marketed animals to increase in weight. As Diarra's paper describes, animal fattening has grown dramatically around Bamako over the period in question (Diarra, 1997).

In conjunction with the possibility that offtake rates have increased, the evidence that animal weights at slaughter has not fallen suggests that overall meat production has risen.
This provides weak evidence that animal productivity has increased through improvements in natural herd growth rates which have allowed offtake rates to increase as well. If true, these changes may be associated with investments in herd vaccination campaigns during the last thirty years.

Conclusions

The greatest scope for livestock production growth exists in the agropastoral zones both through raising herd numbers and productivity in these regions. This implies that public efforts to support livestock (including research, or services associated with animal health, nutrition, market development etc.) should concentrate in these zones.

A further basis for a shift in emphasis in public services to the livestock sector is the increasing importance of small ruminants in all systems except where dry season water control and therefore crops are available.

The role of agricultural development initiatives appears to be strongly positive in encouraging livestock production in association with these efforts. This has been the case in both the Office du Niger and in the CMDT zones of cotton production. These results suggest an indirect but positive contribution that measures to improve the productivity of crop agriculture make for livestock numbers in the same region. On the other hand, crop yield shows no correlation to herd size in agropastoral systems and a weakly negative correlation in pastoral systems. This suggests that crop yields have little bearing on herd size in associated livestock systems and so the positive contribution of development initiatives may be through other effects such as improved access to inputs, extension services, market information or other spill-overs to livestock from crop development activities.

Although the expansion of crop area is negatively associated with herd growth for all livestock systems, it is not a significant association in any except systems associated with dry season crops or with longterm agricultural development activities. This suggests that in these areas, there is substantial competition between animals and crops for dry season pastures suitable for irrigation or recession cropping, or with labor use in agriculture.

The analysis confirms the impact of drought in shifting herds from pastoral systems associated with dryland crops to systems which have dry season crops due either to irrigation or flood recession. This has implications for investments in water control and for drought response strategies. First, to the extent that dryseason agriculture buffers herd losses from other systems during drought, this effect should be factored into the benefits of these systems in assessing public investments. It also suggests that programs targeted to pastoralists during droughts should address this transfer of animals in their strategies.

The study also found weak evidence based upon aggregate data that herd offtake rates and animal weights have both increased over time. Plausible explanations of each are, respectively, the impacts of public animal health interventions in reducing mortality and raising reproduction performance, and the development of seasonal fattening activities to raise animal weights.

Chapter III

PROJECTIONS OF LIVESTOCK SUPPLY AND DEMAND FOR MALI

Earlier studies have demonstrated a growing regional market for red meat in West Africa. This growth is a direct function of rapidly increasing population of the region, and is destined to accelerate with development, as personal incomes begin to rise. Income elasticities for protein, and red meat in particular, are known to be high throughout the region, with estimates for red meat ranging from .6 to 1.4. Together, the impact of population and income projections suggest growth rates on the order of 4% to 6%, depending on estimates of income growth rates. Red meat demand will also accelerate with the pace of urban population growth since urban consumers consume more per capita than their rural counterparts.

By comparison, projections of supply growth in the West Africa region based on past trend suggest rates of less than 2% over the past several decades (Metzel and Cook, 1993). Although the recent past was admittedly a stagnant period in agricultural growth in the region, even optimistic projections of supply growth do not predict a narrowing of the meat consumption gap for most coastal West African countries. For this reason there is no doubt that excess demand for red meat will continue to grow in this region.

This projected regional deficit in red meat represents an opportunity for Mali's livestock exporters but also a dilemma since Mali faces the same challenge to accelerate supply growth if it is going to sustain an exportable surplus. This chapter revisits projections of supply and demand for Malian red meat in order to understand the issues which will are most likely to influence the prospects for sustaining Mali's red meat surplus.

Baseline Projections of Mali's Demand and Supply of Red Meat

Previous projections of supply and demand for red meat in Mali have suggested that with a continuation of current population growth and only modest increases in per capita income (1% annually), demand growth will outpace optimistic projections of growth in ruminant livestock production such that within several decades, Mali will be unable to meet its own demand for livestock products, thereby ending significant exports (Metzel and Cook , 1993, pp. 136-140).[6] This study has revised these estimates based upon more careful assessments of supply potential based upon the analyses of factors explaining growth in Chapter 2 (above).[7]

Demand assumptions

[6]. These projections rely on assumptions concerning rates of growth in herd growth and productivity which are derived from optimistic scenarios a by Winrock's study of *Animal Agriculture in Sub-Saharan Africa*, (1992).

[7] Annexe A gives detailed assumptions used in the analysis. Additional explanation of the supply and demand analysesi s presented in Doumbia's component study entitled "Analyse des Tendances et des Projections de l'Offre et de la Demande de Viande Rouge au Mali" Draft report, November 1996.

Demand scenarios are built for rural and urban components of Mali's population based upon separate growth rate estimates for each of these sub-populations over the next twenty years. The fastest growth is expected to be concentrated in the capital and regional urban centers yielding an urban growth rate of about 5.3%, while in rural areas overall growth is estimated at 1.5%. This yields an overall average annual population growth rate of 2.4% over the next twenty years. Base levels of consumption of red meat in each of these populations are derived from FAO statistics for 1990. Assumptions of income elasticities of red meat are taken from Metzel and Cook (1993)[8]. These are summarized in Table 3.1 Below The projections are detailed in the component study conducted by Doumbia (1997).

Table 3.1
Baseline Assumptions Of Consumption Levels And Income Elasticities

	Beef & Veal	Sheep & Goat	Offal & fat
Consumption Per Capita (Kg/Capita/Year)			
Rural	5.4	3.8	2.3
Urban	8.0	4.7	3.0
Income Elasticities of Demand			
Rural	1.00	1.00	0.60
Urban	0.80	0.80	0.50

Based on these assumptions, two demand projections are presented Graph 3.1 which highlight the crucial role of income growth in red meat demand projections. A base case projection assumes real per capita income growth of 1% annually, requiring annual growth rates above 3.4 % . The second assumption assumes even more optimistic growth of 3% per capita GDP growth, implying GDP growth rates that surpass 5.4 % .

Supply assumptions

The above scenarios are compared to two alternative supply scenarios. The first reflects long-term trend growth of supply for both pastoral and agropastoral systems. This scenario is pessimistic in that it does not account for increasing productivity nor accelerating growth of herd numbers over past trends

Compared to this "historical trend" projection, a second scenario, called the "base case" reflects what are considered realistically achievable targets for growth based upon evidence of changes in performance presented in Chapter II. They incorporate the following assumptions.

- Pastoral herd size at 0% growth. This assumption recognizes that pastoral zone systems have reached approximate maximum levels due to biomass constraints, although there may be substantial inter-annual variation due to climatic variations.
- Agropastoral herd size growth at long term trend levels. These levels are between 1.4% and 4.3% depending on the species and subsystem, and reflect continuing capacity to expand herd numbers in

[8] Their assumptions draw principally on Delgado and Lent (1992) and Lowdermilk (1991).

agropastoral zones for the foreseeable future. (See Table 2, Chapter 2)

- Productivity improvements per head due to continued increases in offtake rates in both pastoral and agropastoral systems of 0.3% for cattle and 0.4% for small ruminants. These rates reflect long term trend increases found in overall performance data. (See Chapter 2)
- Additional productivity improvements per head in agropastoral systems of 0.7% due to increases in animal weights due to increased fattening activity. These projections are again based upon evidence of growth in weights of this magnitude around Bamako due to the emergence of fattening activties (see Chapter II).

Results of these projections are graphed in Graph 3.1 below.

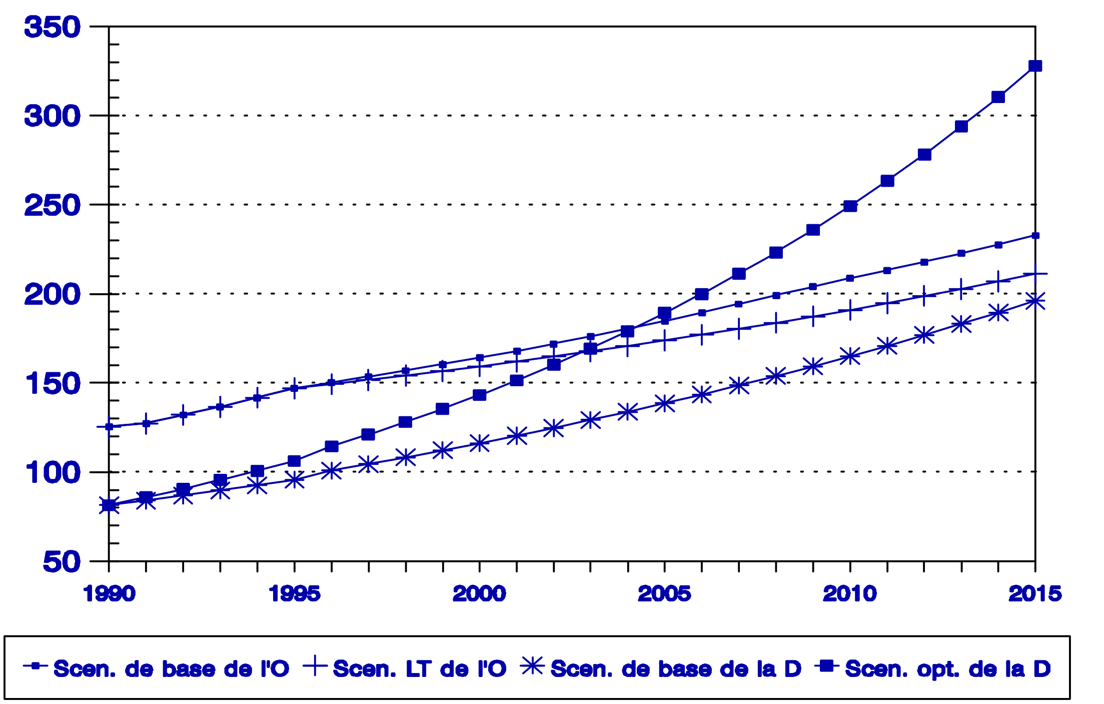
Graph 3.1

Projections of Supply and Demand for Red Meat in Mali

(thousand metric tons)

Projection de l'Offre et de la Demande interieure de Viande Rouge du Mali

(milliers de tonnes)



Legend:

Supply	Base case	- -	*Demand*	Base case	✳
	Historical Trend	- -		Optimistic case - -	

Graph 3.1 shows a change from net exporting to net importing status for Mali where demand projections cross above supply projections.   It demonstrates that rapid income growth (3%) could effectively end large-scale exports of livestock from Mali by the year 2002 if supply growth continues based on past long run trend, and under the base case supply scenario the additional time allowed only puts off the point of net deficit production by a year or two.

Under more moderate income growth (1%), however, the level of surplus generated by the livestock sector under the base case scenario nearly keeps pace with demand growth for the next twenty years. These conclusions illustrate that the better the Malian economy does, the more rapidly livestock exports will slow. Another important impact on demand projections could be due to relative price changes for livestock products. The section following examines this possibility in more detail.

Sensitivity of Supply to Production Parameters.

The base case supply analysis presented in Graph 3.1 is constructed to reflect clearly feasible projections based upon evidence of increasing productivity. However, even better performance could be obtained with more rapid development of agropastoral systems which still have surplus feed resources. However, because there is no substantive basis for alternative scenarios, sensitivity analyses are used instead to illustrate the impact of various production parameters on supply.   These analyses were based on models herd simulation constructed for each of the six systems using data from MORE (1992), Wagenaar et.al (1986), Wilson (1986) and Metzel and Cook (1993).[9]

[9] Annex A gives assumptions used in the simulation analysis.

Table 3.2
Sensitivity of Supply projections to Production parameters

Production parameter	*Parameter Average across six systems*	*Impact of 10% change in production parameter*		*Elasticity of production to parameter*
		Beef production (tons, yr 2010)	*% change from base case*	
Base case production		116234		
Age at sale (yrs)(1)				
male	4.2	110434	95.0%	-0.499
female	9.7	112902	97.1%	-0.287
Mortality rates (%)				
calves (<1 yr)	16.7%	111454	95.9%	-0.411
adults ((>1 yr)	8.5%	107375	92.4%	-0.762
Reproduction				
Age at first birthing (months)	58.7	111566	96.0%	-0.402
Fecundity rate (2)	64.0%	127252	109.5%	0.948

Note: (1) The analysis of age sensitivity is incomplete in that it does not account for changing weight with age, but only the effect of increasing animal turnover on offtake rates, assuming on change in weight.
(2) The fecundity rate is the ratio of births (inclusive of dead births) to reproductive females.

Table 3.2 illustrates the sensitivity of supply to various herd productivity parameters for cattle. The most important parameter is the reproductive rate (expressed here as the fecundity rate). The elasticity parameter (0.95) suggests that there is an almost one to one correspondence between the percent change in this rate and the percent change in supply. This parameter is also one for which performance in the Sahel is substantially worse than in other regions raising *bos indicus* cattle. For example, under similar climatic conditions, but with substantially better health care and nutrition, similar cattle in South Africa, achieve nearly 90% reproductive rates, while ILCA has obtained rates as low as 75% at research station farms in Mali. (Radostits and Blood, 1985, ILCA). Another reproduction parameter for which production also shows substantial elasticity is the age of first birthing (-0.40). Again, this parameter (58 months) is far from norms obtained for similar breeds under on-farm conditions in developed countries (24 months). A number of measures have been identified by research to improve both of these parameters. Among the most effective is simply improving nutrition to receptive and pregnant females through nutrient and vitamin supplementation (Radostits and Blood, 1985). Protection or treatment against common debilitating diseases such as trypanosomiasis can also substantially reduce morbidity and raise reproductive performance.

Production shows strong sensitivity to mortality rates as well. The elasticity for adult mortality is misleading in that this rate applies to all adult age groups whereas the rate for young animals applies only to those one years old or less. Thus, on an annualized basis, reducing mortality among the young far more important in raising production. These parameters can again be influenced directly by nutritional and health interventions as well as by animal husbandry practices to reduce the transmission of disease, particularly in the dry season, when animals are concentrated around watering holes and are more stressed.

Finally, production shows strong negative elasticity to animal age at offtake (-0.50 for males, -0.29 for females), suggesting the benefit of removing animals particularly males, earlier from herds. However, this parameter overstates the benefit of early offtake because in the simulation it affects the herd in aggregate and so does not account for the reduced body mass of younger animals. Nonetheless, the simulation does demonstrate benefits of increasing the turnover of animals, assuming weight is not compromised. Especially in light of the long herd life of animals compared to more commercial animal raising enterprises in other countries, this suggests the potential for accelerating weight gain in younger animals.

Animal weight at offtake is not treated in Table 3.2 above, because of the one to one relation to production. The evidence presented in Chapter II of increasing animal weights at slaughter around Bamako due to the increase in fattening activities, and findings in Chapter III of increasing profitability in small fattening enterprises suggest that such fattening activities could substantially raise production just through seasonal fattening. Further research is needed however to examine the prospects for obtaining similar results for younger animals, and for obtaining similar results in seasons other than the dry season.

Finally, estimates of the elasticity of livestock supply response to price can be estimated from equation 1 of Chapter II above. This analysis is not undertaken because of weak evidence of supply price elasticity.

Analysis of Price Effects on Demand Projections

On the demand side, the projections in Graph 6.1 do not account for differences in growth of demand that may occur due to long term relative price changes in meat and other protein sources. However, evaluations of world price projections for red meat point to several important developments that may change the long term cost of meat.

The Uruguay Round of Gatt One important influence on prices has been the Uruguay round of the GATT negotiations, which resulted in agreements to liberalize agricultural trade among the most important traders in the world market. The most important provisions of this agreement with respect to the red meat trade are limits on the levels of subsidy for EU exports of meat, and commitments by various important importers to allow greater access to their markets, including the introduction of more flexible tariff quotas in the US and Canada, the reduction of import tariffs in Japan, and the increase of minimum access commitments in South Korea (Jarvis et.al, 1995). Both sets of measures should serve to strengthen prices on world markets.

Enlargement of the FMD-free zone Other changes in world red meat prices are expected to result from the certification of Argentina and Uruguay as Food and Mouth Disease (FMD) free countries. As noted in the previous chapter, this shift is expected to simultaneously lower prices of meat from FMD-free countries while raising prices of meat from FMD - endemic countries such as Mali. Taking these changes together with the GATT changes noted above, Jarvis et.al (1995, p.55.) project a gradual increase in prices of meat from FMD endemic countries on the order of 20% in real terms over the next five years.

Growth of semi-industrial poultry production Finally, within Mali, red meat prices may be expected to rise in relative terms in comparison to poultry meat. This may occur with the rapid growth of industrial poultry production. Currently, semi-industrial production of poultry is just beginning in Mali. However, production techniques for semi-industrial poultry are well tested and easily transferable assuming basic conditions are adequate. The principal cost under modern conditions are feed costs, particularly maize and protein cake. Both of these are relatively cheap in Mali compared to world prices. A private chick hatchery for broilers and layers is being started near Bamako this year and the sudden increase in the price of red meat after the devaluation in 1994, and the steady increase in maize production in southern Mali, provide good conditions for it to expand rapidly.

Assumptions

To examine the effects of these changes on demand for red meat, a number of simulations were evaluated which incorporated a long term demand response to price into the demand projections for red meat. Table 3.3 below reports the price assumptions used in the scenario analysis. Price level assumptions use projections by Rosengrant et al.(1997) based upon IFPRI's IMPACT model of global food projections (Rosegrant,et al, 1997). The level of increase to the year 2010 is nearly identical to the 20% increase predicted by Jarvis (as noted above), although the causes of this increase are not clearly spelled out. The expected fall in real prices for poultry shown in Table 3.3 reflects both the expectation that relative prices of poultry to beef will fall on world markets, as well as the impact which modern technology can have in reducing poultry production costs in Mali such that relative prices in Mali reflect the same ratio as on the World market.

Table 3.3
Price Assumptions (CFA/kg retail)

	Red meat	White meat
Price projections		
Mali 1996	1200	1429
World ref. 1996	1200	1023
2010	1523	973
Price Elasticities		
Own price	1.17	1.16
Cross price(1)	0.17	0.69

Note (1) Column product demand with respect to price of other product.

Price and cross price elasticities of demand for red and white meat shown in Table 3.3 were drawn from Lowdermilk (1991) and Delgado (1992), respectively. Lowdermilk's estimates of own price elasticities for red meat were based upon expenditure data in Bamako. Although she did not evaluate elasticities for poultry, she did find an elasticity of 1.16 for peanut butter, another protein source. Given the closeness of the result to that for beef, the peanut butter cross price elasticities were borrowed from Delgado's (1992) analysis for Cote d'Ivoire to use as a parameter for the cross price elasticity of demand for red meat with respect to the poultry price. These results were derived from total expenditure data.

The analysis evaluates two new scenarios for the projection of Malian demand for red meat . These are compared to the moderate income growth case reported in the previous section which assumes no changes in world prices for red and white meat. (This base case is labeled Scenario I in this analysis.) Scenario II evaluates the impact on red meat demand of changes in the real price of red meat for the year 2010 reported in Table 3.3. In this analysis, changes to reach projected levels are assumed to occur between year 2000 and year 2010.[10] No cross-price effects are assumed in this scenario.

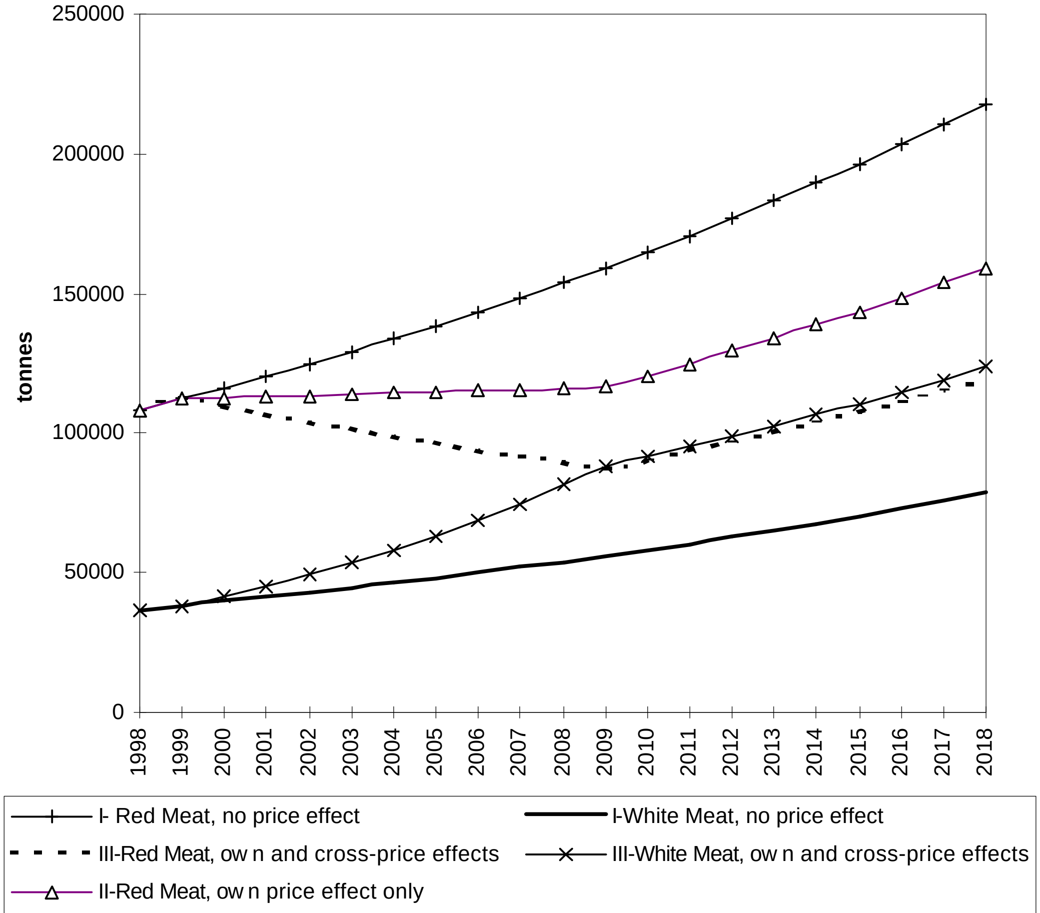
Finally, Scenario III assumes the same projected change in red meat prices, but also a change in domestic white meat prices to reflect relative prices which are projected for the world market.[11] This scenario derives from the assumption that Mali is able to develop a modern poultry production industry which is competitive for export within the region. This scenario is buttressed by the fact that Mali already exports small volumes of poultry across the border from Sikasso to Cote d'Ivoire. Assuming this trend continues, Mali should face the same price differential for that projected to hold on the world market.

[10] The shift to projected prices occurs in equal annual increments over the five years.

[11] Another means of projecting this price was also examined in which the new price of white meat was evaluated as a weighted function of prices of maize and soya meal components of poultry production. The resultant projected price was nearly identical than the one used ($978 as opposed to $973/ ton), and so produced nearly identical results to Scenario III.

Graph 3.2

Impact of Price Effects on Malian Demand for Red and White Meat



Resultant projections are depicted in Graph 3.2. It illustrates the substantial reduction in demand for red meat that may occur from expected increases in red meat real prices by the year 2010. Moreover, a nearly equivalent reduction (shown as the difference between Scenario II and III may occur with anticipated reductions in poultry price due to possible evolution of that sector. Together the two effects produce a reduction of nearly one third in demand for red meat by the end of the assumed transitional phase (2010). Of course while the respective price changes are tied to expected world price changes, the synchronization of these shifts with a transformation in Mali's poultry production sector is largely contrived to show the potential combined effects, should poultry industrialization proceed at a pace with changes in relative prices on world markets. Nonetheless, current investments in the poultry sector, including hatcheries to produce parent stock for both layer and broiler production based on stock imported from Ghana suggest that this process is indeed underway.

Conclusions

As a basis for discussion of the future of the livestock export sector for Mali, the projections analysis reconfirms the fact that if past trends in domestic consumption and production of red meat continue, total consumption will overtake production in the next ten years, and Mali will lose earnings from livestock exports. Only raw or tanned hid and skin exports would likely increase under this scenario as local slaughter increases.

On the other hand, the analysis also illustrates two important sets of assumptions which each provide feasible scenarios for sustaining the export market. First, on the supply side, the sensitivity of production growth to biological productivity parameters, and the current low level of some of these parameters in comparison to norms in more developed livestock systems suggest that there is ample room to raise productivity above levels that have persisted in the last thirty years. These changes are most likely to sustain production growth, in the agropastoral systems where feed biomass remains in surplus. Agropastoral systems associated with rainfed cereals or rent crops each have substantial capacity. Livestock systems associated with irrigated crops might also expand rapidly if private investment in irrigation occurs.

Secondly, price changes are likely to depress demand for red meat. This may occur first due to the emergence of cheaper industrially produced poultry within Mali. Moreover, projected increases in the world prices for red meat could further dampen demand for red meat in Mali, and increase consumption of poultry as a substitute.

Other uncertain parameters such as the pace of per capita income growth and the rate of urbanization could offset the moderating effects of red meat price increases on domestic red meat demand growth if they increase more rapidly than projected.

Lastly, whether supply or demand changes occur as projected in the domestic market for red meat, could to a large extent be influenced by policy. Improvements in supply due to productivity increases are likely to be associated with investments in improved health, diet, and intensification of production through such activities as fattening. The next chapter examines this latter prospect. Changes in demand due to world price changes will be automatic as long as policy allows a flow through of price changes from world markets. Finally, although not examined by this study, evidence from similar transitions in other countries suggest that the emergence of poultry (or other protein alternatives) may be most rapidly advanced by improving the climate for private investments in new agro-industries (Metzel and Cord, 1988).

Chapter IV

THE POTENTIAL FOR SMALL SCALE FATTENING ENTERPRISES

Fattening enterprises in western countries typically take immature feeder animals and bring them to market weight for sale to slaughter. Cattle in these enterprises typically enter the feedlot at well under one year old and are fattened for 6 months. Fattening enterprises in Mali differ substantially from these enterprises, in that Malian fattening enterprises typically fatten mature and therefore much older animals (5 to 7 years old) for shorter durations (typically 3 months). Animals are purchased based upon their large conformation and thinness. Most fattening animals have already reached their full skeletal size. As such, these enterprises more closely resemble fattening of culled cows in western economies. However, in Mali most fattened animals are male, because females are smaller and are not typically culled until they are much older.

With few exceptions, animals are fattened in the hot dry season. They are typically purchased in January and February at the end of the cold dry season when prices are low. Prices rise over the period of fattening through June and July.[12] This price movement is because the greatest number of animal sales from Mali occurs in the cold dry season. Two important seasonal phenomena cause this sell off. First, animal conditioning reaches a peak and then begins to decline during this season as biomass availability begins to run low (Wilson, 1986). Secondly, cereal prices (millet, sorghum, maize and rice) are lowest in the cold dry season, as farmers complete their rainfed cereal harvests. For this reason pastoralists make animal sales to raise cash in order to make cereal purchases in this period.

Thus instead of taking advantage of animal skeletal growth in the finishing process, as in the west, Malian fattening enterprises instead take advantage of seasonal changes in weight and price. As the livestock sector in Mali seeks to raise the value of its product, one would expect that the fattening process would increasingly take on characteristics of the finishing process in more developed sectors. This implies that the age of animals entering the fattening process would fall, and the practice would increasingly become a year round process as the enterprises seek to maximize weight gain from growth, rather than simply seasonal fluctuations in body weight and price.

Fattening analysis objectives

This chapter reports the results of a component study of this report which was conducted by N'thio Alpha Diarra in order to understand the current health of the fattening industry in Mali, its prospects for development, and the opportunity for it to contribute to raising export value added of the livestock sector.

In addition to these general objectives, another reason for revisiting the prospects for fattening was the important positive impact of the FCFA devaluation in 1994 on the livestock sector.

[12] Various analyses of seasonal trends in livestock prices in the Sahel support this contention. Stryker, 1975, Andrew Cook, 1996, Cord, 1991 and IDA, Mali Livestock Sector Project., 1975

The effect on fattening enterprises seemed ambiguous in comparison to traditional systems because of the much higher intensity of use of tradeable inputs in fattening. An important question for the study, therefore, was to assess the impact of the devaluation on the profitability of these enterprises.

Past experiences with fattening in Mali

Initial investments

Since independence, numerous public investments have been made to promote commercial fattening of livestock in Mali.[13] In the 1960's CFDT, the cotton company undertook measures to encourage small scale fattening among its farmers, and by the 1970's public investments were made in other fattening projects including a large scale feedlot at Tienfala in association with the sugar mills there. The ECIBEV project, begun in the mid-seventies, also invested in small scale fattening schemes in areas around Koulikoro, Segou and Banamba (Harms, 1979). At the same time, around Bamako small fattening peri-urban fattening activities became popular to serve demand for meat in the Bamako market.

Efforts to encourage fattening at the farm level typically relied to a great extent on the extension of subsidized credit as a means of increasing the incentive to participate in these schemes. Although some of these credit schemes were able to operate effectively for short intervals, in general, none of these schemes have been a clear financial success because reimbursement rates have been insufficient to maintain, much less increase their initial capitalization. This failure has been attributed in large part to the design and administration of these credit schemes, which lacked the ability to enforce repayment, or sanction. Financial difficulties were also exacerbated by the loss of competitiveness of these enterprises during the 1980's particularly as the CFA franc became increasingly overvalued, and the wider Malian economy stagnated.

Other components of these projects were the extension of technical assistance, animal health care, and the provision of agro-industrial byproducts as subsidized rates. These subsidies created a multi-tiered market for cotton seed cake which continues to the present, and is described below.

Recent trends

While many of the formal efforts have failed, Diarra documents a continuation of fattening activity in each of the zones where these initial efforts where made. In recent years, he explicitly documents the strength of this movement through a census of credit programs which support fattening. Below (Table 4.1), a summary of the amount disbursed through these efforts clearly shows a rapid progression in formal credit going to fattening enterprises. The survey conducted by Diarra also found that most producers were financing a substantial share of their fattening activities from their own funds, suggesting that the scale of fattening activities is substantially larger than reflected below. Another positive development for the sector has been the fact that several private banks have become involved in the extension of credit to fatteners. While this suggests that the security and returns to these enterprises are becoming commercially attractive to private investors, public guarantee funds have supported these banks, and therefore the significance of their interest in fattening is ambiguous.

[13] Grayzel, 1974, Stryker 1975, Harmes 1979, USAID Bamako 1982, Shapiro 1992, Coulibaly 1993.

Table 4.1
Recent Evolution of Formal Credit Disbursed for Fattening in Mali[1]
(thousand CFA)

	1991-92	1992-93	1993-94	1994-95	1995-96
OHVN	58755	39328	60407	6701	184433
PROFED	1203	6128	10057	23927	50525
NOVIB			16240	9750	16240
Comm. Femm.					2000
Plan		4000	9630	14900	18500
BNDA -Banamba		29664	29664	36146	48410
ECIBEV			37815	46205	65138
BNDA - CMDT		318190	111695	302206	508156
Total	59958	397310	275508	439835	893402

Source: Synthesis of Tables … in Diarra, 1997.
Notes:
[1]These data are partial in that there may be other uncensused credit lines for credit.
OHVN = 0peration Haute Vallee Niger
PROFED= Programme Femmes et Developpement
CF = Commissariat aux femmes
BNDA = Banque National de Developpement Agricole
ECIBEV = Etablissement de Credit et de l'Investissement dans les secteurs de Betail et de la Viande
CMDT = Compagnie Malienne de Developpement des Textiles

Fattening Survey Approach

Survey design

Using veterinary agents of the CMDT, the study conducted surveys of fattening enterprises in six villages in the regions of Fana, and Bamako between January and June of 1996. The survey followed each enterprise through one fattening cycle. Cycles ranged between 40 and 91 days in length for cattle, and between 49 and 62 days for sheep. Two to four visits were made to each enterprise depending on the length of the fattening cycle. Cost budgets were completed by agents at each visit, and in some cases animal weights were estimated using conversions formulas from thoracic measurements.[14]

Enterprise characteristics

Sufficient data was obtained on thirteen cattle fattening enterprises (representing 152 cattle) and 6 sheep fattening enterprises (representing 65 sheep) to allow their inclusion in an analysis of economic performance. Herds were classified as either "paysanne" or "semi-intensive" based upon perceptions of the interviewers. It was found however, that neither herd size, nor management variables were closely correlated with this classification Rather this categorization appeared to be more closely

[14] Weights gains were not obtained in all cases because either owners did not wish to have the animals handled by the interviewers, or only one weighing was made.

associated with whether the principal employment of the animal owner was a farmer or other activity.

Herd size, however, was closely correlated with various management techniques for cattle. Tables 4.2 and 4.3 below summarize herd characteristics and expenses for inputs by fattening system based upon a division of both cattle and sheep enterprises between those with less than tens and those with ten or more animals. A more detailed budget is provided in Annex B. Using this distinction, the small scale cattle fattening enterprises are of substantially shorter duration (9 days less) than the large enterprises. Moreover, per animal-day of fattening, health costs, commercial feeds, hired labor and permanent structures for stabling the animals are all much greater for the large cattle enterprises. As would be expected, family labor and use of crop residues and forage crops are greater for the small cattle enterprises.

For sheep fattening, on the other hand, the herd size distinction does not reveal the same clear differences in the duration of the fattening enterprise, nor in most input cost categories although the same trend towards increased use of agro-industrial byproducts is apparent with larger herds. This suggests that for sheep, the range of herd sizes in the sample (between 2 and 26 animals) was too small to establish important management differences.

Table 4.2
Characteristics of Surveyed Fattening Enterprises

Fattening system	Units	**Cattle**			**Sheep**		
		Total sample	***Large (>9 hd)***	***Small (<10 hd)***	***Total sample***	***Large (>9 hd)***	***Small (<10 hd)***
Length of fattening period	days	57.9	68.0	49.3	56.3	55.7	5
Average herd size	head	8.4	14.0	3.6	6.7	12.0	
Number of enterprises in sample	head	13	6	7	6	3	
Number of animals in sample	head	109	84	25	40	36	
Number of animals weighed	head	35	25	10	2	0	
Daily weight gain	grams/ head	704.	821	658	330	NA	3
Fattening Units	head-days	7536	6219	1317	2243	2011	2

Animal weight gain

Animal weight gain for cattle was found to be 658 g/day for small herds and 821 g/day for the larger enterprises. This difference was found to be statistically significant at the 1% level. These results indicate a 25% increase in technical performance by the larger lots. Larger herds also showed greater consistency in gain, with gains ranging from 550 to 1100 g/day , while small herds shows a range of -60 to 980 g/day. As a comparator to this performance, adult oxen achieve their greatest annual weight gain during the rainy season when biomass is in excess supply. During this period average daily gain is about 500 g/day (R.T. Wilson, December, 1986, p.55). These gains are even more substantial when consideration is taken of the loss which is typically incurred during the dry season period of fattening by unfattened animals. This loss is typically on the order of 15%-20% for adult animals that do not receive feed supplementation.[15] (Mali Livestock II Study, 1982) Average sheep weight gain of 330 g/day is also a respectable result, although no significance can be attached to this number due to the very small sample (n=2).

Cost Analysis and Principle Constraints

Cost breakdowns

As Table 4.3 illustrates, for all types of fattening, feed costs represent by far the most important category of cost. Interestingly, both as absolute value and as a share of costs; feed was less important expense for large cattle producers (37%) than small producers (68%) despite the fact that small producers also had greater access to subsidized feeds (see discussion below). This result occurs because of higher costs paid by small producers for crop residues. This result may reflect greater access to face mange or crop residue biomass by large fatteners, or a lower share of crop residues in their food ration.

On the other hand, fixed costs (almost entirely for animal shelter), labor, and health are higher for large herds. Fixed costs rise because the presence of large herds typically requires a separate facility to house the animals, where as one or two animals are usually housed within the family compound. Labor costs rise dramatically because large herds require the engagement of salaried labor, for which salaries ranged between 450- and 1000 F. CFA/day. Small herds use only family labor. While this was also valued (at 500 CFA/day), overall requirements are less, presumably because the activity is a marginal activity of the family rather than the primary occupation of a hired worker. Differences in health costs are perhaps a function of increased transmission of disease in large enterprises due to proximity of animals. Capital costs are roughly equivalent across herd types, reflecting the fact that it is largely a direct proportion of animal value.

[15] ILCA studies have documented that adult male Zebu oxen typically reach a maximum average weight of 315 kg at the end of the rains, and by the end of January this weight falls to 290 kg. Without supplemental feeding weights continue to fall to 270 kg at the end of May before beginning to rebound. (R.T. Wilson, December 1986).

Table 4.3
Unit Costs of Fattening Systems in Mali
(CFA / Fattening Unit [a])

	Cattle			Sheep	
Fattening system	*Total sample*	*Large (>9 hd)*	*Small (<10 hd)*	*Total sample*	*Lc*
I. Costs					
A. Health	162.82	186.58	50.62	13.4	
B. Feed	253.71	232.40	354.34	47.6	
Agro-industrial feeds	180.42	186.26	152.84	24.03	
Crop residues	57.25	36.94	153.19	11.58	
Forrage crops	16.03	9.20	48.31	12.01	
C. Labor	36.95	41.71	14.50	11.7	
Family labor	2.70	0.20	14.50	11.7	
Salaried labor	34.25	41.51	0.00	0.0	
D. Fixed costs	112.74	124.09	59.12	5.8	
Animal shelter	106.15	124.03	21.74	1.81	
Other equipment/infrastructure	6.58	0.06	37.38	3.98	
E. Capital costs	42.94	43.76	39.07	8.1	
Total Costs	609.16	628.54	517.64	86.6	
II. Benefits					
A. Gross margin on l'stk	980.88	910.11	1315.05	357.4	
B. By products (manure)	101.98	69.14	257.02	34.2	
Total Benefits	1082.86	979.26	1572.08	391.6	
III. Net Benefits	473.70	350.72	1054.44	305.0	

Notes: a. Fattening unit represents one animal-day of fattening. All costs are expressed in 1996 F. CFA.

Capital use and credit constraints

The most commonly raised constraint identified by producers was one of financing their animal purchases. The importance of this constraint may be in part a function of capital costs in overall costs, but may also reflect the interest in expanding production. "Excess" demand for subsidized credit funds made available through various projects or banks for fattening activities may also have amplified expressions of this constraint.

Explicit capital costs in fattening evaluated as the interest paid on loans for fattening enterprises, represent 7% of total financial costs. These include principally capital costs for the animal (6%), and credit for inputs (principally, feed and medical care (1%). If the implied annual interest of declared credit payments with respect to all working capital (animals, inputs, labor health and fixed costs) is calculated based upon an average 180 day credit cycle, it represents a compound rate of 12.4% for cattle and 13.6% for sheep, although these imputed rates fall to 5.9% and 6.5% respectively if the implied loans are not paid off for a year.

Based upon the assumption of a 180 day turn around on credit, these numbers suggest that in fact producers are at or above formal market rates for their credit needs because currently most formal credit is provided through public projects at rates of 12% for the fattening cycle. These rates are also in line with private commercial credit (18-28% per annum) but are thought to be lower than the shadow value of capital for such small scale activities. The presence of a higher shadow value is demonstrated by the unwillingness of private banks to lend for these types of enterprises without public guarantees.

Excess demand is typically managed by setting quotas which are allocated to fattening cooperatives, and to individuals within these organizations. An increasing share of new investors are therefore using their own funds, or funds raised through private sources. This process suggests that this type of activity is being funded at the margin in informal credit markets.

Feed costs and constraints

Fattening enterprises represent a departure from traditional livestock raising in Mali principally because they involve the investment of labor or cash in the delivery of feeds to relatively stationary animals instead of grazing animals where feedstuffs are freely available as either pasture or crop residues. The shift to more intensive feeding can be seen in changing patterns of use for three important feed groups: agroindustiral byproducts, crop residues, and forage crops.

Agro-industrial byproducts The principal agroindustrial byproduct used in fattening is cotton seed cake, although, sugarcane molasses and peanut cake are also available in some markets. In order encourage the use of cotton seed cake in animal feeds, Mali has pursued a policy of subsidizing cotton seed cake to the domestic livestock sector. A quota policy exists for the disposal of this cake, which requires HUICOMA to sell the cake at an administered price which is substantially subsidized with respect to market pries. Half of all cake produced by cotton of the CMDT and OHVN is returned to them to be sold back to their cotton farmers at a price which is further subsidized with respect to the market. Another allocation is provided to the Chambre de l'Agriculture which distributes the allocation to its regional offices. Finally the Direction National de l'Elevage receives an allocation for feed security stocks which are also placed in each of the regions.

Cotton production rose by 40% between 1995 and 1996, setting a record of 400 thousand tons in 1996. HUICOMA the oil milling parastatal has attempted to expand refining capacity space to provide for domestic oil needs. This has resulted in a substantial increase in the volume of cotton seed cake that is being produced. It is not clear that the full extent of the impact of this expansion in supply was reflected in the market when the fattening analysis was conducted, however, since a substantial subsidy remained on cotton seed cake obtained through the quota arrangements described above. Table 4.4 summarizes prices paid by farmers in the survey for cotton seed from different sources in 1996.

Table 4.4
Agroindustrial Byproduct Use in Fattening
(kg/day/animal)

			Cattle			Sheep
	Unit[a]	Price (F.CFA)	*Total sample*	*Large, Semi-industrial*	*Small Farm*	*Total sample*
CMDT cottonseed cake	sac	1520.00	0.609	0.060	3.203	0.758
HUICOMA cottonseed cake	sac	1750.00	0.033	0.040	0.000	0.000
Market cottonseed cake	sac	2602.50	2.459	2.795	0.875	0.018
Other cake	sac	3250.00	0.166	0.201	0.000	0.000
Bran	sac	552.50	1.085	1.281	0.161	0.002
Molasses	barrel	7483.93	0.071	0.075	0.054	0.000

Note: a. Sac = 50 kg. Barrel = 200 liter.

As Table 4.4 reveals, the price for CMDT cake is less than 60% of the average market rate (although the market rate varied in the sample between 2000 and 3000 CFA/sac). HUICOMA cake was less subsidized than CMDT but remains substantial (<70%) in comparison to the market rate. The category "other" cake is valued at the highest price, which may reflect the fact that it includes not only cotton seed cake but also peanut cake.

The table illustrates a much stronger reliance on CMDT cottonseed cake by smaller cattle fatteners, and all sheep fatteners, whereas larger cattle fattening enterprises rely almost entirely on the market. This finding is consistent with the fact that CMDT farmers, who are more likely to have small fattening operations, are the only individuals with direct access to CMDT subsidized cake. Huicoma also provides cake at a subsidized price but very few in any group of fatteners had access to this study.

The larger fattening enterprises are least dependent on the subsidized cakes to operate, suggesting both that this subsidy is not a necessary to the expansion of the sector and that without the subsidy there would likely be an increasing shift to these larger "semi-industrial" enterprises.

Crop residues: In some villages questioned during a rapid rural appraisal of livestock activities, respondents indicated that there has been a noticeable change has occurred in the disposal of crop residues in many of the regions, with cereal straw and stover increasingly being harvested rather than left in the fields to be grazed. However, markets for these byproducts are not yet developed in the region, and the value of thes products is typically valued by users as simply the cost of collecting and transporting them to the point of consumption. Diarra's study also notes growth in popularity of manual and motorized feed mixers, used primarily to mix straw and stover with more palatable feeds (molasses, urea, legume hay and/or oilseed cake), although no statistics on this activity are provided.

Forage crops: Some forage crops can be identified in agropastoral systems of Mali although they remain a minor component of these systems. The most common forage crops are dolique, and forage cowpeas, both of which are intercropped with dryland cereals. Use of forage crops was very limited among the enterprises surveyed, although anecdotal evidence from some farmers suggests that cultivation of these crops is expanding. Legume hay is now present in most weekly markets in the towns of the region.

Health costs

Health costs represent one quarter of total costs for cattle and 15% of costs for small ruminants. These costs are almost entirely for preventive medications and vaccines. These costs are typically required by creditors in order to obtain access to loans to purchase animals. For all categories of fatteners, trypanocide treatments were the largest single health expense. This category includes both preventative treatments, and curative doses where animals manifest symptoms of the disease. Internal parasite treatments are the second most important expense, in all categories, but particularly in larger herds, presumably because of the increased risks of contagion. Vaccines are a consistent but much smaller health cost in all systems. These results highlight the importance of trypanosomiasis as a constraint to fattening. This is so because the disease causes wasting. Given the high costs for trypanocides, one hypothesis raised by the study is that fatteners are in fact selecting for animals that are in poor condition because of trypanosomiasis, which they then treat with drugs and then fatten. Unfortunately, the survey is unable to test this hypothesis.

Financial and Economic Performance

Financial profitability

Summary financial results presented in Table 4.5 show that financial returns per animal have been consistently positive this year, with benefit/cost ratios averaging 1.85 for large scale cattle fattening enterprises, and 4.08 and 4.52 for small cattle and sheep operations. These results suggest attractive returns for the large cattle enterprises and very high returns for both cattle and sheep fattening in small operations. However, these returns are only indicative given the small sample size and the fact that the survey was conducted during only one season and in a relatively limited area of Mali. Moreover, they clearly reflect exceptional success levels given that all sampled enterprises were profitable. This suggests that fortuitous price movements, rather than weight gain was the major contributor to benefit during the sampled period.

Table 4.5
Net Financial and Economic Performance Of
Cattle and Sheep Fattening
(CFA/head)

	Financial value	*Taxation on tradeables*	*Taxation on nontrade.*	*Economic value*	*Tradeable component*
Cattle fattening: large					
Cost	30083	909	906	28267	14156
Benefit	55710	0	0	55710	52404
Net benefit	25627	-909	-906	27442	38248
Benefit Cost Ratio	1.85			1.97	3.70
Cattle fattening: small					
Cost	5240	-4546	-2090	11876	8135
Benefit	21367	0	0	21367	18765
Net benefit	16127	4546	2090	9491	10630
Benefit Cost Ratio	4.08			1.80	2.31
Sheep fattening					
Cost	4881	-342	-279	5502	2920
Benefit	22062	0	0	22062	20134
Net benefit	17181	342	279	16560	17213
Benefit Cost Ratio	4.52			4.01	6.89

Price effects on profitability

To test the contribution of price movements to gross margin increases, a paired t-test of unit live weight prices was evaluated for the subset of animals which had both initial and final weighings. The results confirm that unit prices for all animals increased substantially over the course of the period of the survey. Differences in mean unit prices between purchase and sale were shown to be significantly different at the 1% significance level for cattle. Insufficient cases were available in the sheep survey to test significance.

The evidence of unit price increases may have been due to price movements in general or to an increase in the perceived quality of the animal due to fattening. The data did not allow a disaggregation of these two effects because no unfattened animals were followed in the survey. Price data for the period collected in regional markets in the area does confirm a price increase per head, although not of the same magnitude as the price increases for these animals. This suggests that the price increase was in part a market price movement, and in part an increase due to the perceived quality of the animal.

To the extent that unit prices for animals do vary seasonally in a consistent manner, the ability of fattening to take advantage of this variation is a legitimate benefit of these schemes. This is so because fattened animals would otherwise either be sold at their initial weight and lower unit value at the beginning of the season as evaluated by the analysis, or they would be sold at better prices but in substantially worse shape at the end of the fattening season.

Impact of the devaluation

One issue raised by the study was the impact of the devaluation on incentives to fatten. Given the relatively high tradeable component of costs compared to traditional pastoralism, one hypothesis was that the devaluation would not have substantially improved incentives for fattening.

A simple scenario analysis of the impact of the devaluation on cattle fattening is reported in Table 4.6. It assumes the full impact of the devaluation was passed on to tradeable inputs (100% price increase) but only an 80% increase in product prices (as meat prices currently reflect due to the dampening of demand as a result of price increases). The scenario also accounts for the increase in nontradeable costs as general inflation rose after the devaluation. It does not account for likely reductions in the relative shares of tradeable inputs in production as their relative costs have risen. Rather it assumes the same input output coefficients as were found in the post devaluation survey.

Table 4.6
Impact of the Devaluation on Cattle Fattening

	Prior to devaluation CFA/head	Post-devaluation CFA/head	% Increase
Costs	23457	40143	71%
Tradeable component	11146	22292	100%
Nontradeable component	12312	17852	45%
Benefits	43612	77076	77%
Tradeable component	39539	71170	80%
Nontradeable component	4074	5907	45%
Net Benefit	20155	36933	83%

The scenario analysis suggests that while costs increased by 71% due to the devaluation, benefits rose by 77% and net benefits by 83% due to the devaluation. Clearly, although other systems may have had lower cost increases and therefore an even greater incentive boost, fattening enterprises did received a substantial rise in profitability due to the devaluation of the CFA. This result is explainable by the much smaller share of tradeables in inputs (less than 60%) in comparison to more than 90% of the product of the product. Thus the value added in the fattening which was already positive, was nearly doubled by the devaluation.

Economic returns

Net economic returns are also strongly positive in all cases in Table 4.5. Net economic benefits of 27000 CFA and 9000 CFA/head for large and small scale cattle fattening, respectively, and 16000 CFA/head for sheep suggest a strong economic value added in all of these activities. Calculations of the marginal Domestic Resource Costs (DRC) also demonstrates a strong comparative advantage for these forms of fattening in Mali.[16] Table 4.7 reports marginal DRCs of 0.65 and 0.46, respectively, for large and small scale cattle fattening and 0.19 for sheep fattening. These results are consistent with other assessment of comparative advantage in fattening in the Sahel by Metzel and Cook (1993) which found DRCs of 0.65 to 0.75 for cattle and .56 to .65 for sheep under similar conditions to those of this study at Pouytenga in Burkina Faso. However, the same study found fattening under large-scale parastatal industrial fattening conditions to have negative economic value (DRC = 1.77).

The strong comparative advantage of the fattening enterprises examined is due to three factors. First, gross economic margins were high in the sample; however, this result may be exaggerated due to fortuitous price movements in 1996. Secondly, very few tradeable inputs, particularly feeds, were used in production in the sample. This may be a function of the fact that most enterprises were very small and could therefore support feed requirements from byproducts of their own crop activities. Finally, labor resources also bore low opportunity costs because much of it was furnished by the family. Both of the latter two advantages would be diminished in larger scale enterprises.

Table 4.7
Indicators of Protection and Comparative Advantage

	Nominal Protection Coefficient		Effective Protection Coefficient	Domestic Resource Cost Coefficient
	Product	Inputs		
Cattle fattening: Large	1.00	1.06	0.98	0.65
Cattle fattening: Small	1.00	0.44	1.43	0.46
Sheep fattening	1.00	0.88	1.02	0.19

Policy distortions

Interestingly, however, the economic return is lower than financial returns for both small scale cattle and sheep fattening, but higher for large scale cattle fattening. This implies that both small farm activities are subsidized while large scale cattle fattening is taxed. This fact is also illustrated in Table 4.7, which shows that while no distortions are present on the product side (Nominal Protection Coefficients equal one), on the input side, small cattle fatteners and sheep fatteners pay only 44% and 88% , respectively, of the economic cost for tradeable inputs, while large cattle fatteners pay 106% of their value. The subsidy to the first two groups is again the impact of cotton seed cake subsidies for which the large scale enterprises do not have access.
Indirect taxation of some medical inputs represented only a small tax which is insufficient to offset the value of these subsidies. The effective protection coefficient, representing the ration of financial value added to economic value added, combines input and product effects. It shows that due primarily to the imbalance in distribution of cotton seed subsidies to large and small operators, large operators are very slightly taxed by current policy (EPC = 0.98), while small fatteners are strongly protected (EPC = 1.43). Elimination of the current quotas and subsidies in the cotton seed market would eliminate this difference.

[16] Marginal DRCs treat the unfattened animal as a tradeable input into the fattening activity, and evaluate the ratio of nontradeable costs (labor, capital and land costs) to the value added in production (the gross margin less tradeable inputs).

Given the high benefit cost ratio even for economic performance (b/c = 1.97 for large scale cattle, 1.80 for small scale cattle, and 4.01 for sheep), the analysis implies that the subsidy programs currently in place are not necessary in order to promote fattening. However, their removal will have a disproportionate impact on small scale cattle fattening enterprises. Their net financial benefits per head will fall well below those of large scale cattle fattening, and sheep fattening activities and therefore there will likely be a concentration of fattening operations if such a policy is pursued.

Other Constraints to Fattening

Extension services. This need for greater access to technical and marketing advice in undertaking fattening operations was raised as an important problem by fatteners during informal discussions of constraints. Specifically, they mentioned the need for advice on how to care for sick animals, and/or feeding animals. This constraint is likely to be all-the-more important in other zones because the bulk of the survey was conducted in the CMDT zone, where the provision of extension advice on techniques of fattening is already substantially greater than the cost of the agropastoral zones of Mali.

Competition with agriculture. A constraint that current micro-economic literature identifies as a potential problem with livestock systems in the agropastoral zone is the competition that these systems may pose for agriculture (see Chapter 2). However, these problems were notably absent from issues raised by fatteners, suggesting that small scale fattening is in fact not a major competitor for agricultural resources. This may be explainable by the fact that all the fattening systems evaluated were in rainfed crop areas, and were conducted in the dry season when no rainfed crops can be cultivated.

Conclusions

The study documents a dynamic and relatively new sub-sector that is emerging in central and southern Mali to raise value in livestock through short term seasonal fattening. This industry takes advantage of several complementary phenomena:

- thin but healthy animals bought in from more northerly pastoral zones,
- the availability of relatively abundant crop residues
- the expansion of low valued cotton seed cake
- the seasonal unit price increase for animals over the hot dry season
- the proximity to cattle trading routes to southern commercial markets

The prospects for expansion of fattening appear attractive both in financial and economic terms. Economically, the most competitive enterprises are small farm-based enterprises and sheep enterprises because these typically draw on surplus byproducts of the farm and low-opportunity cost labor. However, the prospects of expanding this activity are limited by the availability of these cheap resources.

Larger commercial fattening operations are also economically attractive, however, and present greater prospects for expanding fattening activities in the long run. Various constraints to growth of the sector identified by the study include: 1) access to protein feed concentrates, particularly cotton seed cake, 2) access to and timely delivery of seasonal financing of fattening, 3) information on prices in source and destination markets, 4) inadequate knowledge or technology to make optimal use of local feed resources in feed rations, and 5) competition with agriculture for access to production factors.

The emergence of fattening represents a natural development in the process of specialization of the livestock production industry as it becomes more market oriented. This development may be viewed as a move out on the long run supply curve for red meat in response to increasing demand. Seen in this context, this process implies a reduction in the comparative advantage of traditional livestock producers to the extent that fattening enterprises are more intensive in capital and tradeable commodities which have high local opportunity costs. Thus these enterprises are less robust with respect to variations in world meat prices and the opportunity cost of capital. On the other hand they still represent a net gain in economic value to the economy at the intensive margin and to the extent that extensive options are limited, they also reflect the direction of future growth of the production industry.

In a larger context, these fattening enterprises also fit into the paradigm of production stratification. In this paradigm, northern arid areas of Mali, which are characterized by healthy but feed constrained environments, would specialize in animal reproduction while more southerly systems, where higher valued feeds are more available, would concentrate on fattening grown animals for market. An intermediate phase of growing out young animals also fits within this paradigm, but evidence of this type of system has yet to distinguish itself from reproductive systems in a geographic sense in Mali. On the other hand, within some herding systems in Mali, such as those documented by ILCA in the Delta region, herds of reproductive females are separated from herds of males and pre-reproductive females for the purposes of management. These developments suggest that with the increasing pull of markets for livestock, systems are evolving to increase the efficiency of use of resources and to raise final product value.

Chapter V

PROSPECTS FOR RED MEAT EXPORTS FROM MALI

The idea of locating points of slaughter in the Sahel, processing byproducts locally and exporting chilled or frozen meat to consuming markets has been a recurring one for Sahelian planners since the early 1970s. The attractions of this concept include the promise of capturing the value-added in slaughter and in the processing of byproducts, particularly the tanning industry. In addition, the necessary refrigeration infrastructure for such an industry represents an important evolution in the modernization of these industries and held the promise of developing a more regular supply and higher quality product. In Mali as well as Burkina Faso and Niger, large investments were made to realize this dream. Modern refrigerated abattoir were constructed with the vision of filling both domestic and export potentials and marketing agencies were created to export the product. To date, however, none of these ventures have proven successful as exporting industries although they continue to function to meet domestic demand.

On the other hand, the substantial increase in returns to livestock after the CFA devaluation in 1994, growing demand for red meat throughout the region, and improvements in transport and other market infrastructural capacity over time have raised the attraction of Sahelian slaughter and export of red meat. Because of these prospects, and the resurgence of interest on the part of government and private actors that they have created, the study sought to reexamine the issue of the prospects for red meat exports from Mali.

Component Study Approach

To undertake the component study by Diakité (1977) on which this chapter is based, a series of interviews were conducted with actors in the sector in order to develop scenarios of costs for live animals and red meat exports to several regional markets. For live animal exports, these costs were relatively easy to collect through interviews with intermediaries in the livestock market chain. A number of previous studies also provided numerous comparisons for the purposes of verification. With respect to fresh meat exports, however, the lack of any recent experiences required that the study rely on hypothetical costs constructed from a few experiences of trade in similar commodities such as frozen fish and fresh fruit. Detailed budgets for the analyses reported in the study are found in the annexes of Diakité (1997). However, some differences exist between his study results and this synthesis due to corrections and updates after the completion of his analysis. Annex C presents revised tables from his study, and additional assumptions used for the analysis reported below.

Important parameters which influence the prospects for exporting red meat from Mali include differences in slaughter costs, and byproduct value between Mali and consuming countries and differences in the cost of transporting livestock and refrigerated meat. Each of these costs is influenced by the proposed market that is targeted. This strategy includes both the location, form and quality of the product that is to be exported. These issues of strategy are examined first, followed by an analysis of current price and cost differentials and a financial and economic analysis of the prospects for red meat trade in each market.

Where to Market Red Meat?

The regional market

Mali's only important market for its livestock is currently coastal West Africa, of which Côte d'Ivoire represents by far the largest client (>80 %), although Ghana, Senegal, Liberia and Nigeria have also been important markets in the recent past. Virtually all trade is in live animals.[17] Although none of these coastal West African markets have purchased significant amounts of slaughtered red meat from Mali in the past, projections presented in the next chapter suggest that they are important potential markets.

As current importers of Mali's livestock, these markets are the obvious target for developing red meat exports. Business relationships in the meat trade are already well developed, tastes and quality preferences are already well understood, and there are no important sanitary restrictions against Malian meat in these countries since health conditions are similar in all countries of the region.[18]

Each of the coastal importers of Malian livestock also import red meat from world markets. However, in Côte d'Ivoire and Senegal, the volume of meat imports from world markets have decreased dramatically in the last two years as Sahelian meat has become more competitive as a result of the CFA devaluation.

Long distance, disease tolerant markets

A second set of markets for red meat might be described as the long distance, disease tolerant markets. These include other importing countries in Africa of which Algeria, Libya and Gabon have been clients in the past, as well as most of the Middle East. These markets are labeled *disease tolerant* in that they do import meat from countries which are not certified as free of important epizootic diseases, of which foot and mouth disease (FMD) is the most important. Other sources of meat for these countries include Eastern Europe and Latin America, which also are not FMD-free.

Unlike coastal West Africa, however, quality distinctions based upon meat cut and finish are increasingly important in these markets. Range-fed meat, particularly for small ruminants is given a premium over meat finished on grain and agro-industrial byproducts such as is imported from eastern Europe. This preference gives Mali a distinctive advantage in these markets, particularly over Eastern European meat which is fed on much higher proportions of agroindustrial byproducts. For example, preferences for range fed meat in North Africa and the Middle East ranged between 15% and 50% (Metzel and Salinger, 1989).

Prices of meat in these markets are lower than in FMD free markets. Data comparing Argentinean to other meat prices for similar qualities also suggests that the differential has been as much as 50% and as little as 25% in the past five years (Jarvis et al 1995). This differential in price is

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[17] Many studies have examined the livestock trade in the West African region, including Metzel and Cook, 1994, Umali, Feder and de Hann, (1992), Coste (1993), Ancey (June 1991), OECD/CILSS/Club du Sahel (1987), Sarniguet (1989), Lauras (1990), Sidibé and Josserand (1993), as well as World Bank subsectoral reviews for livestock in each country of the region: Mali (1990), Ghana (1991), Côte d'Ivoire (1992).

[18] All countries do continue to inspect animals for disease, and at least one country, Ghana, officially requires a period of quaranteen for imported animals, but these requirements are typically not restrictive.

projected to shrink as some of the largest producers in this market gain FMD status and therefore shift supply to that market. In particular, Argentina and Uruguay are expected to obtain FMD free status in North America and are seeking it in other large importing markets such as Japan and the European Community.

Shipment by land/sea routes to these markets is a feasible option only if significant improvements in infrastructure are made. Even then, only frozen meat is a feasible product to deliver given the two to three week shipment times that would be entailed.[19] If these markets are accessed by air freight , fresh meat sales can easily be envisioned. While these have already been done on a small scale, larger scale shipments would require additional infrastructure particularly to maintain the cold storage chain between the slaughter house and the aircraft in Mali.

Opportunities to market fresh or frozen red meat in other markets are currently limited to countries which are not certified as free of foot and mouth disease (FMD). This excludes the EC, Canada, the United States, and Japan which are among the world's largest importers. The prospects for overcoming the FMD restriction to allow fresh meat entry to that large market are not a short term possibility because removal of the restriction requires that Mali cease to vaccinate against FMD. Despite the fact that an FMD outbreak has not been documented in Mali for several years, the presence of FMD in neighboring countries, and the substantial uncontrolled flows of animals between countries in the region poses an unacceptable risk to Mali until a regional effort to eliminate the disease is successful. Meat from Mali can be exported to these countries if it is first heat treated (or processed in other approved ways). However, these processes also lower the value of the final product by almost half (Jarvis, et. al., 1995).

What Product to Market

While the West African meat trade is still primarily in live animals, world trade in red meat evolved from live animals to carcass meat in the late 1800s, with the perfection of refrigeration, and now it is evolving again from carcass meat to trade in boxed cuts of meat. Boxed meat can mean simply cutting and boxing carcasses in pieces to facilitate handling and transport. It more typically includes cutting into smaller "subprimal" portions, however. Moreover, these cuts may be sorted and shipped to buyers demanding only one type of cut meat. The evolution to boxed meat has been driven by economies in transport of boxed meat , and the ability to better differentiate and target the demands of meat consumers. In the United States, for example, in 1979 less than have of slaughtered meat was sold as cut meat (44%) but this shifted to 84% of all meat sales by the end of 1980s.

The benefits of the boxed meat trade include the ability to differentiate markets for different cuts, and therefore to obtain better prices for each component of the whole carcass.
Savings in transport occur from not having to transport bone/gristle and other waste from the carcass. These amount to about 30 % of carcass weight for Zebu cattle. Boxed beef is also more easily maintained in hygienic conditions; and there are efficiencies in shipment of boxes because they are more easily handled and do not require special equipment that carcasses require.

Offsetting these advantages are the costs of processing and packaging which increase the total

[19] One exception to this may be parts of North Africa, for which overland transport might be feasible from Gao or Tomboctou. This study does not investigate this option.

processing cost of per kilo. In modern slaughterhouse settings, processing costs more than double with a shift from carcass to boxed beef. A survey of American slaughterhouses found that costs increase from roughly $40/head to $ 83/head for a plant with roughly the same capacity as the slaughterhouse in Bamako (Duewer and Nelson, 1991).[20] Of course, added processing costs at the slaughter house reduces these costs by the same amount at the retail level. The increase in product value not only reflects the savings in processing at the retail level but also better targeting of cuts to market demand . Thus profit margins increase with boxed beef. Among American slaughterhouses, revenues per head rose from $762 to $825 per head with a move to boxed beef for the same capacity firms.

The differential in prices for higher quality cuts is likely not to be as great in West African markets due to the weaker differentiation of meat quality. On the other hand, if higher quality meat cuts can be exported to more distant markets by air, a higher price differential between these cuts, and carcass meat is likely to be found than in regional markets. This suggests that a strategy to develop boxed meat exports from Mali should focus first on exporting high quality meat beyond the region, while consuming lower quality cuts within the region. Cost scenarios for this strategy are examined below.

How to Make Best Use of Byproducts

A final strategic issue in seeking to create a profitable slaughter/export industry in Mali is that of obtaining the greatest return on the byproducts of slaughter. At slaughter, these represent about 10% of the slaughter value. The most important byproduct is the organ meat (3.8%), followed by the hide (2.4%). The rest constitutes the value of the head and horns, hooves, blood and other waste. Obviously, given this share of total value, their efficient utilization becomes an significant factor in justifying an increase in their availability through domestic slaughter. More importantly, if their value in consuming markets is greater than in Mali, this could easily offset other economies to domestic slaughter.

Hides and skins

Mali had two private tanneries, one which exploits hides of both small and large ruminant and the other which treats only small ruminants. Both process most of their product to the wet-blue stage, and then export these semi-processed hides to Europe for final tanning. Together the two tanning industries have capacity which approaches current domestic production from slaughter for small ruminants, and with planned expansion by one firm to Kayes, will exceed this capacity. An Algerian firm has also declared its intention to invest in a third private tannery, although no investments have yet been made in this venture. In addition, an export market for raw hide exists which includes a number of small scale traders who export both to industries in neighboring countries (Burkina, Senegal and Côte d'Ivoire) as well as directly to Europe.

[20] These costs were for slaughter of 75 head/hour capacity, and processing 140000 head /year. Cost proportions between slaughter and processing to boxed meat remained roughly equivalent at other scales, however.

Table 5.1
Comparison of Availability Capacity and Current Use of Hides and Skins in Mali

	Cattle hides	Small Ruminant
Availability from slaughter (average1990-95)	407	2310
Total Installed /planned capacity:	176	2970
TAO -SA -Bamako		1540
TAMALI -Bamako	66	660
TAPROMA - Kayes	110	770
Current use (1995)	26	1430
TAO -SA -Bamako		1100
TAMALI -Bamako	26	330

Note: all capacity estimates based on daily turnover capacity times 220 working days/year.

The component analysis for this study by Diakite suggests that a substantial financial advantage (400-570 CFA/kg) may exist to exporting semi-processed (wet-blue) hides and skins to world markets (Diakite, 1997). However, this conclusion is based upon only summary data from two firms. This finding is corroborated by the interest in further expansion of these activities by one of the firms. The advantage of local processing appears to be primarily because of lower labor costs and because costs of environmental cleanup are not strictly imposed. On the other hand, nearly all chemical inputs must be imported, and energy costs are higher in Mali, such that overall costs are not likely to be greatly different from other countries.

The longer run prospects of larger value added by processing to the final tanned stages, were not evaluated by the study due to lack of information. Although a small artisan leather industry already exists, development of a modern leather industry will require a much greater investment, to develop the sector to international standards, train artisans, and assure careful quality control. Although, both existing firms have considered the feasibility of this option, both indicated that risks were high, and given stiff competition and high investment costs neither has immediate plans to do so.

Offal and organ meats

Offal and other edible byproduct of ruminant slaughter represent about 10% of the live animal value in Mali. (See Table 5.2, below.) By comparison, these represent more than 20% of animal value in coastal west African markets, suggesting that, comparatively, offal is under valued in Mali. The relative preference for these products in coastal markets is not only with respect to Malian consumers but also with respect to world markets as is reflected in the fact that organ meat imports are also a large share of Côte d'Ivoire imports from world markets, having displaced red meat import since the CFA devaluation in 1994.

Table 5.2
Value of Cattle Slaughter Byproduct in Three West African Markets

	Bamako	share of livewt value	Abidjan	share of livewt value	percent of Bamako price	Accra	share of livewt value	percent of Bamako price
Hide/skin	3500	2.9%	7000	5.8%	200.0%	4808	4.0%	137.4%
Offal/organs	4500	3.8%	11200	9.3%	248.9%	3769	3.1%	83.8%
Head	3000	2.5%	7000	5.8%	233.3%	9615	8.0%	320.5%
Hooves	2000	1.7%	3200	2.7%	160.0%	5769	4.8%	288.5%
Total byproduct	13000	10.8%	28400	23.7%	218.5%	23962	20.0%	184.3%

Other byproducts

Other byproducts including blood and bone meal, and hoofs and horn, have been exploited in only a limited fashion in Mali due to limited demand for these products, which are typically used in animal feeds. In the last year, however, new investments have been made in small units to process these items at Sikasso and Banko. An increasing demand for these commodities is expected with growth of the animal feed sector, particularly for industrial poultry production.

What Would it Cost?

Slaughtering costs

Most animal slaughter in Mali is still conducted by households for family consumption. However, in urban areas, slaughtering slabs, and slaughter houses have been constructed and are the only authorized sites for slaughter. Of these sites, only the slaughterhouse in Bamako was built to specifications to allow meat exports, as well as to furnish local consumption. Currently, however, it operates only to meet local demand. It rents its facilities to independent meat wholesalers or retailers who buy the animals, slaughter them using its infrastructure, and then sell the carcasses and byproducts themselves. The slaughterhouse provides only the facilities, and utilities (water and electricity). Cold storage may also be rented at additional cost in each case.

Most Sahelian slaughterhouses were initially constructed as part of parastatal institutions with a mandate to buy animals and sell meat. However, direct sales operations have failed in competition with small meat marketers who have slaughtered meat under traditional circumstances. The inability of these slaughterhouses to compete, and the desire to improve slaughtering conditions for the entire market has led governments in the region to abandon their own commercial activities and instead to lease their facilities to the private sector. The Abattoire Frigorifique in Bamako illustrates this progression. It was constructed in 1965 and managed by SONEA (Societe National de l'Exploitation des Abattoires). After several attempts to restructure the parastatal, the government attempted to privatize it in 1980 but was unable to attract interested investors. It therefore undertook it's current role as a public facility rented to the private sector. In recent years, the government has renewed it's efforts to privatize the facilities and there have been various expressions of interest.

However, the most serious of these have been to convert the facility to other uses rather than to continue it's vocation as a slaughter house. These advances have been rebuffed because of the desire of the government to continue to promote red meat processing both for the domestic market and for export.

While services provided by slaughter houses throughout the region do not appear to differ significantly, slaughter fees charged at the slaughter house in Mali currently rank well below costs in coastal slaughter houses , with the exception of Accra (see Table 5.3 below). However, these costs are fixed administratively in each case, and so they do not necessarily reflect actual costs. In the case of Mali, for example, the costs do not incorporate the full costs of capital amortization.

Table 5.3
Slaughterhouse Charges for Slaughter per Head of Cattle (CFA/head)

	Bamako	Sikasso	Abidjan	Dakar	Accra
Cattle	3995	3500	7000	6500	1500

Note: assumes 1300 Cidi /CFA

Comparisons of costs in Mali with modern slaughter industry costs in western countries show an even more dramatic difference. A comparison of carcass and boxed beef costs in the US and in Bamako is provided in Table 5.4. The analyses of boxed beef for Bamako is entirely hypothetical since no boxed beef is currently produced there. It assumes the same percentage increase for nontradeable costs (labor, facilities, utilities) but assumes the same absolute cost increase for all tradeable costs (supplies/containers, equipment, and miscellaneous costs). Inventory costs are added to the total assuming that the slaughterhouse will have to operate as an integrated private venture, while taxation which is currently applied in Mali is also retained.

Table 5.4
Comparison of the Structure of Processing Costs for Carcass and Boxed Cuts for Mali and the USA

	CARCASS USA		***BOXED CUTS USA***		***CARCASS Bamako***		***BOXED CUTS Bamako (hypothetical)***	
	CFA/kg	***% of total***	***CFA/kg***	***% of total***	***CFA/kg***	***% of total***	***CFA/kg***	***% of tota***
COSTS								
Comparable								
Land & Facilities	19.6	23.4%	26.1	14.7%	4.0	9.5%	5.4	4.8
Wages	41.0	48.9%	87.4	49.3%	23.2	54.7%	49.5	44.2
Utilities	4.6	5.5%	4.6	2.6%	4.3	10.0%	4.3	3.8
Supplies/containers	3.1	3.7%	32.2	18.1%	3.0	7.0%	32.0	28.5
Equipment	7.3	8.7%	16.7	9.4%	2.8	6.7%	12.2	10.9
Miscellaneous	6.8	8.1%	8.2	4.6%	1.8	4.2%	3.2	2.8
Sub total	82.4	98.4%	175.2	98.8%	39.1	91.9%	106.6	95.0
Non-Comparable								
Inventory	1.4		2.2				2.2	
Taxes	0.0	0.0%	0.0	0.0%	3.4	8.1%	3.4	3.1
Export certificate	0.0		0.0					
Total costs	83.7	100.0 %	177.3	100.0%	42.5	100.0%	112.2	100.0
BENEFITS								
Sale Price	1313.0		1423.0		1024.0		1423.0	
Purchase Price	1293.8		1293.8		976.0		1293.8	
Gross Margin	19.2	23.0%	129.2	72.9%	48.0	113.0%	129.2	115.2
Net Benefit	-64.5	-77.0%	-48.1	-27.1%	5.5	13.0%	17.1	15.2

Notes:

exchange rate 500 CFA/$

carcass weight 286 kg/head USA 125 kg/head Mali

Table 5.4 illustrates, first, that current costs of slaughter are much lower in Mali than n the United States. The largest cost differences are for wages and facilities. The former, represent a greater proportion of total costs in Mali but are nonetheless much lower in real terms than in the United States, reflecting differences in income levels between the two countries. Facilities costs are less expensive in both absolute and relative terms in Mali. This difference reflects a substantial subsidy component in the investment costs of the Malian slaughter facilities.

The second point illustrated by Table 5.4 is that the move to boxed beef in the United States results in a substantial increase in costs, which more than double as a result of processing to boxed beef. The largest component of this increase is due to the cost of the boxes and plastic required for packaging the beef. Costs for equipment and labor increase but remain a relatively constant proportion of total costs. Other costs - facilities, utilities and miscellaneous - also rise, but fall as a proportion of total costs.

The table also shows that neither slaughter nor slaughter plus processing show net profitability in the United States at a scale equivalent to that of the Bamako facility. The smallest US firms showing profitability have throughput of at least 120 head/hour. Nonetheless, the degree of losses is substantially reduced by moving to boxed beef, a trend which is also sustained for larger firms. Comparison of actual slaughter costs and hypothetical slaughter plus processing costs in Bamako suggests a similar trend of increasing unit costs but also increasing profitability with additional processing. In Mali, however, the entire activity in both cases shows a net positive return at the current scale of the Bamako slaughter house. It should be emphasized however, that the estimated costs of slaughter may under-represent true costs in Bamako to the extent that past public investment cost are ignored by current accounting at the slaughter house.

In modern slaughter industries, scale is also an important factor in costs. Table 5.5 presents some data on scale and throughput of modern slaughter houses in the United States and compares these to current parameters at the Abattoire Frigorifique in Bamako.

Table 5.5
Comparison of Scale in Slaughter House [a]

	units	Mali (ABF)	United States				
Output per year	head	60000	37500	88125	140625	176250	281250
Daily slaughter	head	220	160	376	600	1200	1500
Hours per week	hours	40	40	40	40	40	50
Shifts per day	head	1	2	1	1	2	2
Fixed and Variable Costs	CFA/ head	3995[b]	58210	20615	19570	17580	16380

Note:
[a] Conversions based on the following: Carcass weight in Mali=125 kg/head ; in USA =284 kg/head. Exchange rate = 500 CFA/$.
[b] These do not include fixed costs. See discussion in previous section.

The table demonstrates clearly the dramatic reductions in cost that can be made by increasing the scale of plant operation, and/or the number of shifts per day. Costs per head fall from $130-160 per head for turnovers of less than 10 head per hour, to $70-80 per head for turnovers of 300 per hour. Additional economies are gained by moving to a two shift operation from a single shift operation. Thus the same plant can decrease costs by 10% with a doubling of shifts to raise output. In addition, costs can be dropped an additional 7% by increasing hours of operation per year. These results suggest that substantial gains could be achieved through larger scale, assuming the larger scale could be made to operate at capacity. However, currently the slaughter house does not operate near it’s capacity for even one shift per day and unless a larger international market can be added to local urban demand, this capacity will not be used for another decade. This suggests that an international market is a necessary condition for improvements in technical efficiency at the Bamako abattoire.

Meat Storage and Transport

Infrastructure for handling red meat trade with coastal countries is almost non-existent in Mali. The slaughter house in Bamako does have ten 30 ton chilling chambers (0° - 4° C), and two freezing chambers (-20°C , 25 ton total capacity), although all are not currently functional. In addition, several private cold storage facilities were located in Bamako which are used primarily for imports of fish. No refrigerated trucks could be located which transport between Mali and Abidjan, although two trucks were found that had been purchased for importing frozen fish. Both were not operating however, because costs were determined to be exorbitant. One merchant was also found who imports frozen fish in containers by rail from Dakar. He also had had refrigerated trucks which he had hoped to use to import fish and export red meat from Abidjan. But he had abandoned this venture because of the lack of profitability and had sold them.

The relative costs of transporting red meat instead of live animal are not immediately obvious. On the one hand, the costs of refrigerated transport is substantially higher both because of the higher fixed costs of refrigeration equipment and the higher operating costs of the refrigeration unit. In addition, risks of product loss due to delays in transport or failure of the equipment are certain to be much more important than for failure or delays of transport of live animals. On the other hand, there are savings in the transport of carcass meat over live animals to the extent that lower valued byproducts (e.g. offal), which are not worth transporting by themselves, can be left behind. This would be the case for any products for which the price mark-up between Mali and the consuming country is not sufficient to cover the transport cost. This may be the case for example with respect to the hides and skins, the offal, and other byproducts such as the head, tail, skin and feet. With the move to boxed beef, the same economy can be made with respect to bones.

Table 5.6 below compares financial costs of transport per ton kilometer as well as per kilogram of product transported and per kilogram of carcass, assuming that lives animals are converted to carcass equivalents.[21] The analysis suggests first, that rail transport is the least expensive means of transport for both livestock and carcass. Table 5.6 suggests that trucking to Abidjan is four times as expensive per ton-kilometer as the rail link to Dakar. Secondly, refrigerated transport is substantially more than non-refrigerated costs per unit weight, but when live animals are converted to carcass weight, refrigerated transport is roughly equivalent in cost to live animal transport by rail, and is substantially cheaper than livestock for truck transport. These results assume, however, full capacity use and no losses in storage in any scenario.

Air freight is, of course, much more expensive than any other form of transport. These costs are high not only in comparison to other modes of transport, but also in comparison to international standard rates for air freight. This is so because of a near monopoly which Air Afrique holds on air freight exports. The current contract between Air Afrique and the Malian government gives it rights to first refusal to freight. This process is lengthy, cumbersome and has served as a deterrent to prospective

[21] Rates cited are based upon Diakités findings. The rates cited in the table, are substantially more than rates for merchandise transport by truck cited by the Annuaire de Statistique de Transport, 1994 (Min. Traveau Publique). These were assessed at 29 FCFA/ton-km on paved roads and 48.75 FCFA/ ton-km on paved roads in February 1994.

shippers. Air freight costs are also high because the airport at Bamako charges service fees which are substantially higher than other airports in the region. They are reputed to be more than five times higher than fees at Accra and Banjul, for example (Ceasro, 1995). A comparison of air freight costs for fresh produce from Africa (Table 5.6) illustrate that the Sahelian CFA countries pay much higher costs than other countries for unit transport. These comparisons suggest that if competitive conditions were fostered for air freight traffic, costs could drop by at least 25% and as much as a half.

Table 5.6
Transport Unit Costs Collected for Mali, 1996[a]

Mode	Route	Product	Shipment weight (kg)	Unit price (FCFA) per Tn-kilometer	Kg shipped	Kg carcass
Truck	B'ko - Abidjan	livestock	8750	60.54	74.29	148.57
Truck	B'ko - Abidjan	carcass	10000	68.87	84.50	84.50
Rail	B'ko - Dakar	livestock	21875	18.29	20.87	41.74
Rail	B'ko - Dakar	carcass	25000	35.69	40.72	40.72
Air	B'ko - Libreville	carcass	30000	140.00	560.00	560.00

Note: [a] All comparisons assume full capacity and no losses in shipment.

Table 5.7
Air Freight Rates from Africa for Fresh Produce, 1995
(FCFA/ Ton-km)

	Paris	London	Amsterdam
WEST AFRICA			
Bamako	**125**	**115**	**140**
Ouagadougou	127	117	143
Niamey	132	121	147
Abidjan	106	101	121
Accra	91	88	84
Banjul	108	101	99
OTHER AFRICA			
Nairobi	91	87	89
Dar Es Salaam	69	84	66
Addis Ababa	61	55	59

Source: Based on green bean shipments, D. Ceasro, "Transport par Avion des Fruits et Legumes de Mali aux Marches d'Exportation", for project DHV, October 1995.

Policy Issues for Meat Trade

Malian trade policies

Since 1989, Mali has been in the process of liberalizing the exports of red meat. This entailed the removal of a substantial export tax, as well as the drastic simplification of procedures for export. Today the only remaining requirements for export are that traders must hold a *patente* to be a livestock marketer and have the correct health documents for the animal. The former qualification must be obtained once a year, and costs between 2100 and 8200 depending on the size of the operation.[22] The latter requirement requires the export herd to be inspected by a veterinarian, although no cost is attached to this process. In a historical context, these remaining restrictions are a dramatic reduction in regulations from those which pertained through the early 1980s. A survey by the APEX project also found that traders' perceive that the difficulties that exporting procedures impose have been substantially reduced in recent years.[23]

Mali also has on the books restrictions against the export of reproductive stock, defined as reproductive females less than 9 years old and males less than 5 years old. Such restrictions were implemented during the past two droughts to prevent the national reproductive heard from leaving the country. Just after the devaluation in 1994, there were again calls to reinforce this restriction to prevent the loss of reproductive capacity. This type of restriction is, however, unnecessary to the extent that the reproductive value of animals is well understood by herders and is expressed in the market prices of these animals. Various studies have demonstrated the efficiency of market prices in reflecting reproductive value as well as other animal characteristics (e.g. weight, and health) in Sahelian livestock markets (Cord, 1991; Cook, 1996). Such rules can be counterproductive, in the long run, however, if for example, they prohibit animal fattening enterprises from maximizing returns to animal growth by fattening younger male animals for sale. As a rule, public efforts to raise value added in the sector through such arbitrary marketing rules are much less efficient than allowing individual producers and traders in the market to determine optimal sales strategies.

Indirect taxation and other policies

Truck transport costs for livestock are inflated in Mali by taxation of vehicles, fuel, lubricants and spare parts. Together these taxes combine to approximately one third of transport costs. In addition, official restrictions on the use of foreign trucks for export could potentially raise transport costs further, although public officials claim that these policies are not enforced.

With respect to air freight, as noted above, preferential contract given to Air Afrique and very high landing and servicing charges at the Bamako airport increase the costs of using air freight. To the extent that these arrangements are fixed by the government that represent a policy cost to livestock trade.

Other indirect taxes in the livestock marketing sector are few. One which deserves investigation is the taxation of telecommunications. Currently telecommunications are used regularly by livestock traders to check on prices in prospective markets in order to prepare plans for marketing. These costs are high in comparison to world standards. Although this study was unable to evaluate the tax element of these costs, they are thought to be an important component of the high cost.

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[22] This includes both the *patente* and the surcharge payed to the Chamber of Commerce. The lower fee is for up to 50 head of animals traded per year, while the highest fee is for 151 to 200 animals. See Diakite, 1997.

[23] Personal communication with Peter Wythe, APEX project based upon preliminary findings of market survey.

Regional border protection

Livestock trade within the West African region has benefited from efforts of the Economic Community of West Africa (ECOWAS) and of the Economic and Monetary Union of West Africa (UEMOA) to reduce restrictions on regional trade for traditional products. Thus livestock face no official export or import taxes in moving between CFA countries in the region. Livestock from Mali did face an import tax of 30 % when entering Ghana in 1995, however in 1996 the Ghanaian government declared its intention to eliminate this tax.

On the other hand, substantial protective barriers have been imposed by coastal West Africa on imports of red meat from world markets, and this has spilled over into the regional market. Most importantly for Malian exporters, Côte d'Ivoire has a variable levy (in addition to a standard ad valorem tax) on meat imported from the EC to counter EC export subsidies on meat. With the increase in consumer prices of meat in Côte d'Ivoire due to the devaluation, the Government of Côte d'Ivoire did lower the variable levy on meat imports from world markets[24] by 60% for most categories of meat.[25] Resultant rates of nominal protection for meat are reported in Table 5.8. In Ghana and Senegal, the two other important markets for Malian meat, there is only an ad valorum tariff on meat imports.

Table 5.8
Official Rates of Nominal Protection for Meat Products in Côte d'Ivoire

	1993/94	current
Fresh or refrigerated beef	50	20
Carcass/half carcass and bone in meat)	200	80
Offal (beef and pork)	40	20

Until now, regional trade in red meat has not received exemption from these same protective measures as livestock because red meat was not considered a raw material *(produit decree).* Until recently, this difference has not been an issue in regional trade because so little of it has been traded intra-regionally. Recently, pressure to grant Sahelian red meat the same privileges as livestock has generated positive commitments for coastal governments (Côte d'Ivoire and Ghana) to review this situation.

Illegal policy restrictions

In addition to official measures to control trade, regional livestock trade in West Africa is constrained by illegal restrictions imposed by public agents who extort bribes in order to permit passage through official check points. For cattle transported from Bamako to Abidjan, Diakite's estimates these costs at 2600 CFA/head. This represent only 5% of net margins per head (sales value less all costs), but approximately one quarter of all marketing costs.

Efforts to reduce this phenomenon have been undertaken by the governments of the region in conjunction with both national and regional initiatives to create a dialogue between actors within the

[24] Arrete No 069 of 26 mai 1995., Circulaire des Douanes n 781 of 26 June 1995.
[25] For poultry, and salted and smoked meats no changes were made.

livestock trade and public agents in order to call attention to the problem and to reduce the costs involved. These efforts appear to have been effective in recent years. In a survey of livestock exporters in 1996 , nearly all respondents in two markets agree that costs of "taxe sauvage" have fallen since the devaluation in 1994. Moreover, estimates of the reduction averaged between 50,000 and 100,000 CFA per truck load of animals (33-35 cattle).[26]

Scenario Analysis of the Prospects for Red Meat Exports

Based upon the various findings discussed above, the study sought to compare alternatives of exporting livestock, carcass meat, or boxed meat to prospective regional and world markets (Diakité, 1997). Table 5.9 below presents comparisons of costs and net financial benefits for livestock and red meat exports to Abidjan and Dakar. Preliminary conclusions derive from these analyses are reported below.

Financial returns

Net financial benefits of exporting from Mali to coastal markets appear to be substantially higher per head for livestock than for chilled or frozen red meat carcass or cut meat exports. The greatest returns currently appear to be in sales to Accra, followed by Abidjan and then Dakar. Higher prices in Accra reflect higher protection on world market imports due to tariffs applied to these imports (see discussion above).

Comparing carcass to boxed meat, both Accra and Dakar markets appear to show a slight financial advantage (lower loss) for boxed meat. In the case of Dakar this appears to be because of the greater efficiency in rail transport for boxed meat, whereas in Accra, the assumed cost differential between boneless and carcass cuts improves the attraction to boxed meat.

A final scenario of exporting beyond the region to world markets, such as in the Middle East or Gabon suggests that boxed meat has a clear advantage over carcass meat. (Livestock exports were not evaluated.) This is largely because of the saving on transport of the low valued bone, and on the greater price differentials assumed for higher quality meat cuts in these markets.

Two principal factors make livestock export more attractive to coastal markets than either carcass or boxed red meat.. First of all and most importantly, coastal markets place a much higher valuation on the byproduct (offal, head, feed, tail, horns and raw hides and skins) than in Mali. The differential is particularly high for raw hides in Abidjan and Accra because these are consumed as food in these areas, but are either tanned or exported to Europe for tanning from Mali. Byproduct values in Table 5.9 are negative because they are treated as a cost in the budget; thus, as *negative* costs, they are in fact benefits. The value of the byproduct of boxed meat is higher than for livestock in all scenarios in Table 5.9 because lower quality meat cuts not exported are included in the byproduct valuation, thereby raising it in comparison to the livestock scenario. This increase is compensated by a reduction in the value of the principal product, however, because less of the animal carcass is sold as principal product.

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[26] Unpublished analysis by Peter Wythe for the APEX project, USAID Mali.

Because all values are expressed per unit carcass, it masks the fact that the unit value per kilogram of the principal product is higher for the boxed meat scenario than for the livestock or carcass scenarios.

Table 5.9

Financial and Economic Value of Alternative Livestock Product Export Scenarios (CFA/head)

	LIVE ANIMAL				*CARCASS MEAT*			*CUT/BOXED MEAT*		
	financial costs	*official taxes*	*illicit taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*
Purchase price Bamako	120000	0	0	120000	120000	0	120000	120000	0	120000
Sale to Abidjan										
Sale price	165000	0	0	165000	164253	0	164253	104264	0	104264
Gross margin	**45000**	**0**	**0**	**45000**	**44253**	**0**	**44253**	**-15736**	**0**	**-15736**
Processing costs	11358	0	0	11358	5120	236	4884	8660	0	8660
Transport costs	24855	820	800	23235	53222	1472	51750	32865	909	31956
Byproduct value	-25357	0	0	-25357	-13000	4200	-17200	-52808	4200	-57008
Total costs	**10855**	**820**	**800**	**9235**	**45343**	**5909**	**39434**	**-11284**	**5109**	**-16393**
Net benefit	**34145**	**-820**	**-800**	**35765**	**-1090**	**-5909**	**4818**	**-4452**	**-5109**	**657**
Sale to Dakar										
Sale price	160000	0	0	160000	143750	0	143750	95923	0	95923
Gross margin	**40000**	**0**	**0**	**40000**	**23750**	**0**	**23750**	**-24077**	**0**	**-24077**
Processing costs	11358	0	0	11358	5120	236	4884	8660	0	8660
Transport costs	29083	2161	200	26722	38493	-24956	63449	23769	-15410	39180
Byproduct value	-25357	0	0	-25357	-13000	4200	-17200	-52808	4200	-57008
Total costs	**15084**	**2161**	**200**	**12723**	**30613**	**-20519**	**51133**	**-20379**	**-11210**	**-9169**
Net benefit	**24916**	**-2161**	**-200**	**27277**	**-6863**	**20519**	**-27383**	**-3698**	**11210**	**-14908**
Sale to Accra										
Sale price	173112	0	0	173112	166667	0	166667	111215	0	111215
Gross margin	**53112**	**0**	**0**	**53112**	**46667**	**0**	**46667**	**-8785**	**0**	**-8785**
Processing costs	3187	0	0	3187	5120	236	4884	8660	0	8660
Transport costs	20511	350	250	19911	64100	1690	62410	39582	1044	38538
Byproduct value	-25357	0	0	-25357	-13000	4200	-17200	-52808	4200	-57008
Total costs	**-1659**	**350**	**250**	**-2259**	**56220**	**6126**	**50094**	**-4567**	**5244**	**-9810**
Net benefit	**54771**	**-350**	**-250**	**55371**	**-9553**	**-6126**	**-3427**	**-4218**	**-5244**	**1025**
Sale to World market										
Sale price					147500	0	147500	204677	0	204677
Gross margin					**27500**	**0**	**27500**	**84677**	**0**	**84677**
Processing costs		**NA**			5120	236	4884	8660	0	8660
Transport costs					165933	9703	156230	102464	5991	
Byproduct value					-13000	4200	-17200	-52808	4200	-57008
Total costs					**158053**	**14139**	**143914**	**58315**	**10191**	**48124**
Net benefit					**-130553**	**-14139**	**-116414**	**26361**	**-10191**	**36553**

The financial analysis assumes, however, the existence of the tax on raw hide and skins exports from Mali (4200 CFA/head). This tax affects carcass and boxed meat export scenarios because the tax lowers the financial value of the byproducts by depressing raw hide/skin prices on the local market. Since the completion of the analysis, this tax was lifted. This change should allow prices of hides and skins to rise to their economic value (the FOB value of raw hides and skins). Although prices reflecting this change were not available for this study, the net impact on financial profitability may be approximated by simply adding the 4200 FCFA/head tax to financial profitability. Doing so results in carcass meat exports to Abidjan and boxed meat exports to Dakar becoming marginally profitable, and boxed meat exports to Abidjan and Accra also nearly reach profitability, although in all cases they are still substantially less profitable than livestock exports. This illustrates the deleterious impact which this tax has had on incentives to develop a red meat exporting sector. In effect by taxing this byproduct of slaughter, the government increased incentives not to slaughter domestically.

Transport costs are a second factor in reducing the attraction of trade in carcass meat. Meat transport is more expensive per unit of final product in all cases than for live animals despite a near doubling in final product weight per truck load because of higher losses in transport and lower capacity utilization for specialized refrigerated transport than for livestock transport. Transport cost comparisons for Bamako - Abidjan by truck, and Bamako - Dakar by train indicate that rates are substantially higher by truck which attests to the greater efficiency of train travel. With a move to boxed beef, transport costs are less per head than for carcass meat, but still almost 50% above live animal costs. By rail, boxed meat costs fall to below costs for the livestock scenario.

The only important cost factor which argues for locating slaughter in the Sahel is the cost of slaughter itself, which is considerably lower in the Sahel than on the coast. This conclusion is apparently due primarily to low labor costs in Mali, but it may also reflect incomplete slaughter cost accounting due to public subsidies in slaughter house operation, given the parastatal administration of the operations of these slaughter houses.

Economic value added in livestock and meat trade and distortions created by policy

The net economic value of either livestock or meat trade is the value which each adds to the welfare of society . This value must be assessed by evaluating products generated and resources used in each activity at their opportunity cost to the society, that is, their most attractive alternative source (for products) or use (for resource inputs). Other analyses have examined the economics of livestock production in Mali. In general, these analyses have demonstrated a strong positive net economic value in production of livestock for export to regional markets in competition with the alternative (or opportunity cost) of importing red meat from world markets (Metzel and Cook, 1993; Metzel, 1995). This study does not revise these analysis, but rather poses the question of the increase in economic value of exporting meat on the hoof in comparison to exporting it as red meat. This “marginal” economic value of each activity is therefore assessed by examining the change in economic value between an exportable animal purchased in Mali, and the same animal slaughtered in the final consuming market, under each scenario. The initial value of the animal itself is netted out of the analysis and is assumed to be entirely tradeable in both cases. Transaction costs in the analysis have been divided up between, slaughter costs, byproduct value, and transport costs. Byproduct values in are negative because they are treated as a cost in the budget; as *negative* costs, they are in fact benefits.

Each of these costs components are divided between those incurred in Mali and those incurred in the country of consumption. This distinction allows an assessment of the allocation of the location of costs and benefits between countries, and so permits an evaluation of economic value from both national and regional perspectives. These are discussed separately below.

The *economic* benefits of livestock or meat marketing are assessed by removal of the official and illegal policy distortions referred to in the previous section from the financial value of trade in each commodity. The distinction between official and illegal policy highlights the fact that some taxes which are assessed on traders do not have official sanction. Rather, they represent bribes which are extorted from traders by authorities at internal and frontier road barriers. Although these "taxes" are not official, they are considered *policy based* distortions because government is deemed responsible for their existence to the extent that government officials levy these taxes and that it is within the power of the government to eliminate the practice.

National Perspective Estimates net economic benefits accounting for distortions due to national policy are reported in the last column under each scenario in Table 5.9. These equate to financial costs net of official and illicit taxation. At the national level, the economic results for livestock exports are consistent with financial returns in terms of signs and orders of magnitude, although in all cases net economic benefits are slightly higher than financial benefits. This difference reflects the net taxation of the sector which currently occurs due taxation of inputs. No distortions are evaluated on the product, since no taxation is levied on livestock exports.

For example, livestock exports toward Abidjan includes official taxation of about 800 CFA per head of cattle. This is only 6% of export costs in Mali but 20% of total transaction costs through slaughter in Abidjan. The tax component rises dramatically as a *share* of total costs only because of the reduction in net costs after byproduct value is deducted. Aside from a small export certificate tax, these taxes are almost entirely indirect taxes on transport in Mali.

The economic analysis for red meat exports, is more complicated due to the existence of a tax on raw hide and skins exports until May 1997. While it existed, this tax decreased the financial return to byproducts of slaughter in Mali, and so increased the negative policy distortion for red meat in comparison to livestock. This impact is reflected in Table 5.9 which shows that due to this tax, net taxation of red meat exports was almost double the net exporting cost from Mali, inclusive of byproduct value. On arrival in Abidjan, net taxation still represented 50% of total transaction costs net of byproduct value, and six times the absolute cost per kilo of meat product brought to the coast on the hoof.

Without the tax on hides and skins, the economic analysis does not change, since the tax is only a transfer between private and public interests in the economy. Of course, as discussed in the previous section, financial analysis would show a gain in byproduct value equivalent to the tax reflected in Table 5.9 (4200 CFA/head).

Illicit taxation, due largely to bribes collected by police, gendarme, and veterinary inspectors are roughly equivalent to official taxes for live animal exports to Abidjan. They have not been estimated for red meat exports in this analysis. It might be argued that refrigerated cargo will face less illicit taxation because the cargo is likely to be sealed and could conceivable be bonded. Nonetheless, the results of the analysis are certain to underestimation financial costs of red meat exports due to this oversight.

There are several reasons that components of the analysis above will change in the medium to long run. First, the price differential for raw hide is exaggerated in the analysis by the depressing effect of a very high export tax on raw hide which has been imposed in Mali in the interest of reducing costs and raising supply to the local tannery industry.[27] However, by dramatically reducing the financial value of this important byproduct, this tax has reduced incentives to slaughter locally, ultimately reducing overall raw hide production.

Furthermore, although most coastal demand for red meat does not differentiate quality, there is already a small market for higher valued cuts of meat which is certain to grow with per capita incomes. This presents the possibility that choice quality carcass meat, or even boxed cuts of high value portions of standard grade meat might be exported competitively to these markets. Finally, as transport infrastructure improves, institutional barriers to commerce fall and risks of moving perishable goods are reduced, transport costs will fall.

[27] Since conducting this analysis, this tax has been rescinded. The case without this tax is reflected in the Economic cost column. The cost of this tax is estimated at CFA 4200 per animal.

Table 5.10
Comparison of Policy Distortions from National and Regional Perspective
(Sale to Abidjan, CFA/head)

	LIVE ANIMAL				*CARCASS MEAT*			*CUT/BOXED MEAT*		
	financial costs	*official taxes*	*illicit taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*
NATIONAL PERSPECTIVE										
Purchase price Bamako	120000	0	0	120000	120000	0	120000	120000	0	120000
Sale price	165000	0	0	165000	164253	0	164253	104264	0	104264
Gross margin	**45000**	**0**	**0**	**45000**	**44253**	**0**	**44253**	**-15736**	**0**	**-15736**
Processing costs	11358	0	0	11358	5120	236	4884	8660	0	8660
Transport costs	24855	820	800	23235	53222	1472	51750	32865	909	31956
Byproduct value	-25357	0	0	-25357	-13000	4200	-17200	-52808	4200	-57008
Total costs	**10855**	**820**	**800**	**9235**	**45343**	**5909**	**39434**	**-11284**	**5109**	**-16393**
Net benefit	**34145**	**-820**	**-800**	**35765**	**-1090**	**-5909**	**4818**	**-4452**	**-5109**	**657**
REGIONAL PERSPECTIVE										
Purchase price Bamako	120000	21639	0	98361	120000	21639	98361	120000	21639	98361
Sale price	165000	29754	0	135246	164253	29619	134633	104264	18802	85462
Gross margin	**45000**	**8115**	**0**	**36885**	**44253**	**7980**	**36273**	**-15736**	**-2838**	**-12898**
Processing costs	11358	993	0	10364	5120	236	4884	8660	0	8660
Transport costs	24855	1871	2606	20378	53222	20848	32375	32865	12874	19991
Byproduct value	-25357	-234	0	-25123	-13000	4200	-17200	-52808	4200	-57008
Total costs	**10855**	**2630**	**2606**	**5620**	**45343**	**25284**	**20058**	**-11284**	**17074**	**-28357**
Net benefit	**34145**	**5485**	**-2606**	**31265**	**-1090**	**-17304**	**16214**	**-4452**	**-19911**	**15459**

Regional economic analysis

Table 5.10 presents a comparison of financial distortions and economic value from the national and regional perspective for the case of sale to Abidjan.[28] The regional perspective assumes a larger definition of policy distortions, by incorporating those of coastal countries which also influence the market for Mali's product. This approach might be viewed as a broader economic perspective for Mali to the extent that Mali is capable of influencing these policies to its advantage, or capturing the transfers associated with these policy distortions. Even in the absence of these conditions, the regional perspective is useful for Mali because pursuit of regional economic value may indirectly spur Mali's own economy through linkages to product and resource markets.

The *regional* case differs from the *national* perspective in three important ways. First, protection to red meat imports from world markets is provided by consuming countries. This results in about a 22% nominal protection to meat prices within Côte d'Ivoire, assuming that Mali comes in under this protection (representing a protection level of 8115 FCFA/head). This is currently the case when livestock is exported but not when red meat is exported from Mali to Côte d'Ivoire. Secondly, additional indirect taxation, principally in transport is included on the cost side. For example, for lives cattle exports, these taxes amount to 820 FCFa/HEAD IN Mali, but similar taxes in Côte d'Ivoire add 1809 FCFA/head. Finally, additional illegal taxation is incurred as livestock transits the coastal country territory in route to the final consuming market. For cattle, this amounts to an additional 1806 FCFA per head in Côte d'Ivoire on top of 800 FCFA/head in Mali.

Together with national level distortions, regional policies provide substantial net protection of livestock exports. Thus, the regional economic value in exporting Malian livestock to Côte d'Ivoire is actually lower than the financial incentive to export. (This is the opposite of the case viewed from Mali's national perspective.) The largest component of this protection is provided by Côte d'Ivoire's ad valorem and variable levies on imports of meat from world markets. Legal and illegal taxation in marketing livestock offset this impact by taxing the sector, but do not fully compensate, thus per head, protection increases financial incentives by about 8100 CFA, while these taxes reduce incentives by about 5200 CFA.

For both carcass and boxed meat exports, the impact of regional protection currently has the opposite effect , however, because red meat is currently unprotected from the world market. Thus, red meat imported by Côte d'Ivoire from Mali is levied the same tax that is applied to imports from Europe. This implies that regional trade in red meat would be heavily taxed if it existed, and this explains in large part why it does not. If on the other hand, the tax on red meat entering Côte d'Ivoire from Mali is lifted, (as has been promised in discussions between these countries), the effect will be similar to that of livestock exports.

Conclusions

The analysis of the prospects for increasing value added through domestic slaughter suggests that under current market conditions, livestock exports remain financially more profitable than either carcass or boxed meat exports to the regional market. In fact, both carcass and boxed meat exports show negative profitability in regional markets under policy conditions that pertained through the beginning of 1997.

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[28] Similar results pertain to other regional markets, although because data was more robust for the Abidjan case, and in the interest of brevity, only it is shown.

The good news for increasing value added through slaughter are twofold. First, due to projections of rapid growth in domestic demand for red meat projected in Chapter III, the slaughter industry and the byproduct industries that depend on it are assured steady growth of between 3% and 6% depending on rates of income growth.

Secondly, several policy changes can make the activity much more attractive for development of export markets as well. First, the removal of the tax on raw hides and skins exports this year has already made both carcass and boxed meat exports marginally profitable opportunities in several West African markets, although they are still much less attractive than livestock exports to these markets. This opportunity is made more interesting if Mali can convince its coastal buyers to give it preferential access to their markets by exempting Malian meat from the tariffs they impose on meat imports from world markets. Even more important for increasing profitability of this trade, however, would be a reduction in transport taxation in coastal countries . An elimination of these taxes would dramatically reduce the costs of moving fresh and frozen product between the Sahel and the coast. This issue is all the more important to the extent that the analysis has not included the costs of illicit taxation in the transport analysis for these products. If illicit taxation is allowed to proliferate in the trade of fresh and frozen meat trade at the same level as it has for livestock, all prospects for a profitable trade disappear.

Another interesting conclusion of the analysis is that there may already be substantial profits in the sale of certain boxed high quality cuts of meat beyond the regional market. This is so if Malian exporters can obtain similar prices for high quality cuts that other FMD endemic exporters such as Argentina have obtained in the Middle East. This opportunity suggests a strategy for developing Mali's slaughter industry that would target these markets first as small scale opportunities to develop the expertise, infrastructure and services to market quality meat products in foreign markets. These developments might then allow cost reductions that would permit Mali to develop emerging markets for higher quality in its traditional coastal West African markets.

Lastly, the analysis also demonstrates the strong detrimental effect which ad-hoc policies to favor specific value-adding industries can have on the general development of a sub-sector. This was the case with respect to the tanning industry in Mali, which sought to protect its access to raw hides and skins exports by obtaining a tax on their export. While this policy seemed to encourage the tanning industry, it had the negative effect of reducing incentives to domestic slaughter by depressing the value of the hide and skin byproduct. Thus it raised relative incentives to export livestock to the detriment of the domestic slaughter industry. A more evenhanded policy of low taxation for the entire sector will promote investment in the sector, while allowing private actors to determine the most lucrative investments to raise their financial returns, and thereby the sector's economic returns.

Chapter VI

A POLICY AGENDA FOR LIVESTOCK EXPORTS

This study has explored prospects for increasing the contribution of the livestock sector to Mali's economy through measures targeted at the export of it's product. The analysis has included investigation of determinants of livestock production growth, and assessments of adding value in production through fattening, and in marketing through domestic slaughter and exporting of red meat. Findings for these analyses suggest a number of policy measures which can contribute to increasing the value of exports from Malian livestock. These can be summarized under three principal challenges: accelerating production to assure an exportable surplus, increasing the efficiency of marketing , and increasing economic value added in processing. This chapter summarizes these findings and issues , and proposes policy initiatives to address each of these challenges, respectively.

Accelerating Production

Findings and Issues

Trends outlined in Chapter III suggest that domestic demand will increasingly compete with the export market for livestock product. The prospects that demand growth could outstrip supply growth for red meat in Mali highlights the need accelerate production to sustain an exportable surplus of red meat. However, such a goal is only justifiable economically, if Mali can continue to produce livestock at economic costs below world price. Past economic analyses (Metzel and Cook, 1993; Metzel 1995) demonstrate that this is the case under traditional extensive production conditions. However, the analyses of trends suggests that future increases in production must come at the intensive margins through schemes which increase input use per unit of land area. This study has found that pursuing such a strategy through seasonal fattening also shows strong economic comparative advantage.

Trend analyses as well as econometric assessments of determinants of herd growth suggest that the greatest scope for livestock production growth exists in the agro-pastoral zones. By definition, this finding implies an increasing integration of livestock and agriculture. Addressing constraints to this process of integration must therefore be a central focus of any efforts to increase livestock production.

These constraints include increasing competition for land and labor between livestock and crop agriculture. For example, significant negative correlation was found between herd growth and production systems associated with land on which water control is practiced. This is thought to reflect substantial competition between animals and crops for land suitable for both dry season pastures and for irrigation or recession cropping. In rainfed cropped areas, competition for land is much less important, since range pasture biomass is available during the cropping season, however, competition for labor becomes an issue because labor requirements rise in the cropping season as demands for agriculture compete with the need to guard animals to keep them away from the crops.

A further constraint associated with increasing concentrations of livestock in more humid agricultural areas is the greater disease burden in these regions. In particular, the negative effects of trypanosomiasis on herd performance are likely to increase with this trend. Illustrating this, the survey of livestock fatteners found costs of treating trypanosomiasis to be the predominant health expense among animal fatteners. On the other hand, the process of integrating livestock with agriculture may ultimately reduce the threat of trypanosomiasis as land areas cleared for agriculture reduce the habitat for the vector of the disease.

Another finding which may provides a basis for a shift in emphasis in livestock policy is the increasing importance of small ruminants found by the study in all systems except where dry season water control is available. The increasing popularity of small ruminants has been in part due to their greater tolerance of climatic stress which was particularly severe in the 1970s and 1980s, and because they are smaller and therefor more manageable investments for small farmers.

The strong influence of climate and particularly drought conditions on production in all pastoral systems, was also illustrated by the study. The study suggests that the dynamics of herd movements between systems in response to drought could change in the long run as herd densities build in southern zones and agricultural land expands. Yet by raising the permanent herd in more southern regions, the traditional role of these regions as a buffer from drought may be reduced. On the other hand, increasing commercialization of livestock production, and the development of a production stratification strategy across agroclimatic zones may facilitate rapid offtake from more arid zones in stress periods.

The study found substantial evidence for the success of short term (90-120 day) intensive fattening of cattle and sheep based on a survey of enterprises and a review of current projects and financial institutions which give credit for fattening. This industry has developed in areas where proximity to inexpensive sources of high valued feed, and to large livestock collection markets and trucking routes to coastal markets make it attractive. While financing for fattening has increased yearly since 1993, formal credit has been outstripped by increasing financing requests. Facing this constraint, self-financing of fattening activities by farmers appears to be spreading rapidly.

Finally, increasing valuation of crop byproducts used for fattening also corroborates evidence of increasing interest in fattening. Feed availability in the dry season is a crucial component of successful fattening enterprises. Subsidies for cotton seed cake have facilitated success among small farmers in the cotton producing zone, but these same subsidies and quota allocations of cake to pastoral regions for distribution as emergency feed have reduced availability and raised prices for cake on the open market. These policies have penalized other consumers of cake, in particular larger fattening enterprises who are the most likely to invest their own resources to expand the industry.

Recommendations

These findings suggest the following policy orientations to encourage an acceleration of livestock production:

- Government should place increasing emphasis on providing support services (including research, or services associated with animal health, nutrition, market development to livestock etc.) to agropastoral systems, small ruminant production and small scale fattening enterprises.

- Policy measures should be designed to facilitate efficient resource allocation between livestock and competing interests. These could include strengthening markets for resources, and public institutions and rules governing resource allocation conflicts. Particular issues that should be addressed are rights to land use particularly in the dry season, and particularly in lowland and flood recession areas.

- Drought strategies should be prepared to facilitate the process of offtake during drought and reconstitution after drought. These should target dryland pastoral zones where drought has been shown to have the largest negative impact, and areas such as the Office du Niger and the Delta du Niger regions which absorb animals during drought due to the availability of dry season feed biomass. Reconstitution strategies after drought should target the same zones in the reverse process. Drought policies should also be designed to facilitate animal movement and access of pastoralists to emergency resources. Government efforts to "program" destocking or reconstitution with measures that limit when, what kinds or how many animals may be exported during these periods of crisis are counterproductive and should be avoided. They only increase uncertainty, impede market performance, and reduce opportunities for livestock producers to mitigate risk.

- To raise productivity, an important area of opportunity is in improving reproductive performance of ruminants. Currently rates of reproduction are low compared to potential for both cattle and small ruminants. Other studies have suggested that improvements in nutrition, health care and animal genetics can each substantially improve reproductive rates. Improvements in profitability of livestock since the CFA devaluation have made these investments increasingly attractive.

- Fattening activities in agricultural zones should be another focus of new investments. Constraints faced by fattening enterprises, included access to protein feed concentrates, particularly cotton seed cake, access to and timely delivery of seasonal financing of fattening, information on prices in source and destination markets, and advice on optimal feed regimes and on optimal use of local feed resources.

- The government should consider removal of all official restrictions on the market for cake. To give the government a mechanism for responding to feed emergencies, the government should consider replacing fixed stocks with a fund to purchase cake on the market in cases of emergency need.

Increasing the Efficiency of Marketing

Findings and Issues

The analysis has shown that for regional markets, live animal exports are likely to remain the most economical method of trade in comparison to exports of carcass or boxed meat in the foreseeable future. This is so because coastal markets value not only the meat product but also the byproducts of slaughter more highly than Sahelian markets. Thus Mali gains by selling the entire animal in coastal markets. The only savings to slaughter in the Sahel is due to marginally cheaper slaughter costs, but these are more than offset by the higher costs and risks of transporting meat instead of live animals.

On the other hand, the analysis also demonstrates that positive economic value might be obtained from exporting boxed cuts of meat to markets which are Foot and Mouth Disease tolerant, where price differentiation exists based on the quality of certain cuts of meat, and for which lean, grass-fed meat is a preferred characteristic. This is the case of most Middle East and North African markets. Although benefits are not strong under such scenarios, the attraction of such a scenario could increase with gains in efficiency through increasing scale and privatization, reductions in transport costs through deregulation of air freight, and increases in profitability which may occur with projected increases in real world prices.

For trade both long distance and regional trade, high transactions costs exist. In regional trade, a major cost is imposed by unauthorized taxation of transport by public officials. Transport costs are high for all exports, due either to heavy taxation, in the case of trucking, monopoly rents, in the case of air transport, or operating inefficiencies in the case of the railroads. Transaction costs for other services are also high. These include telecommunications costs, delays and fees in repatriation of money, both with non-CFA and CFA zone neighbors, the refusal of formal banks to finance livestock trade, and the lack of institutions to insure shipments of animals or meat product.

Recommendations

These conclusions suggest that the emphasis in regional trade in livestock products should continue to stress improvements in efficiency in the transport of live animals. While the government has already taken measures to facilitate this trade, continued efforts are needed in the following areas:

- Monitor national agents of customs, police, military and veterinary inspection services to eliminate unauthorized taxation of livestock trade;
- Sponsor dialogue among market actors and officials in Mali and in destination countries to sustain progress to reduce high costs associated with unautorized taxation by the same services in coastal countries;
- Disseminate information to livestock traders on prices, marketing opportunities, and changes in official trade regulations in coastal countries;
- Reduce taxation of road transport which is currently applied through taxes on purchase of vehicles and spare parts and taxes on fuel;
- Eliminate restrictions on truck movements across borders based on nationality of registration;
- Liberalizate air freight services out of Mali to increase competition, lower costs and improve availability and service. In particular, Air Afrique's privileged contract should be renegotiated to encourage competitors.
- Increase capacity of the Bamako-Dakar railway to transport live animals, and containers. While costs of exporting by rail appear to be substantially cheaper, there appears to be a access constraint to use of the railroad for livestock product exports, (both for live animals and for containers for either hides and skins or refrigerated product).

Increase Value Added in the Livestock Processing

Findings and Issues

Red meat exports to regional markets are not likely to be competitive with livestock exports in the near future. Therefore, plans to base a regional meat exporting strategy on renovation of the Bamako slaughter house are unlikely to be profitable.

On the other hand, a strategy of targeting high-end long distance export markets for red meat exports might be attractive in the near future if high transaction costs can be overcome. This trade is likely to be small scale, but would provide valuable experience to Malian exporters with which to develop the infrastructure for a larger market. At the same time, the local and regional market for high quality cuts could also be develop. The presence of economies of scale in marketing suggest that over time costs would fall.

The government should therefore encourage private initiatives to invest in local slaughter capacity to the extent that these investments will serve to meet increasing domestic demand, better differentiate livestock products, develop meat marketing infrastructure and raise the value of slaughter byproducts. Each of these objectives will also facilitate penetration of export markets for red meat as lucrative opportunities are identified. In the longer term, regional trade in red meat may become successful as quality differentiation increases for meat products.

Public efforts to liberalize exports across the board have had the intended effect of raising economic profitability of the sector and value-added to the economy. However, selective policies to encourage value-added in the tanning industry by taxing raw hides and skins exports have had the reverse effect on the slaughter industry by reducing the domestic value hides and skins which are slaughter byproducts. An alternative strategy which would raise returns to both slaughter and tanning industries would be to lower transaction costs, and operating inefficiencies in Mali to facilitate the necessary investments in new industries.

Recommendations

Some specific measures that should be considered to promote an expansion of value added in livestock processing include the following:

- Introduce investment incentives to encourage private investors to establish slaughter house facilities, regardless of scale, which meet international standards.
- Avoid large direct investments of public resources to promote regional red meat exports since such investments are not likely to be financially attractive.
- Assist private operators to obtain training in processes to meat grades and standards required for meat products for international markets targeted by these operators.
- Assure adequate inspection of meat processing firms to assure that standards are correctly applied.
- Maintain an evenhanded export taxation policy for all livestock products which maintains taxation levels at zero or low levels for all products to avoid bias in investment incentives between value adding sectors.

BIBLIOGRAPHY

CITED WORKS

Ancey, Veronique. *L'impact des viandes extra-Africaines en Côte d'Ivoire sur les échanges régionaux de bétail Africain.* Mémoire de D.E.A., E.H.E.S.S., June, 25, 1991.

Ceasro, D. "Transport par Avion des Fruits et Legumes de Mali aux Marches d'Exportation", for project DHV, October 1995.

Cook, Andrew, "Historical Determinants of Supply and Demand for Livestock in Niger", PhD dissertation, Tufts University, Fletcher School of Law and Diplomacy, Medford, MA. 1996.

Cord, Louise, "The effect of drought and imperfect capital markets on the supply response of Nigerian Pastoralists," PhD dissertation, Tufts University, Fletcher School of Law and Diplomacy, Tufts University, Medford, MA. 1991.

Coulibaly, Mantalla, "Economie D'Elevage: Un regard sur le Cheptel du Mali", Bamako: Imprimerie Nouvelle LINO, 1993.

de Leew, P.N, L. Diarra, and P. Hiernaux. "An analysis of Feed Demand and Supply for Pastoral Livestock in the Gourma Region of Mali," ILLA, Bamako, Mali. Circ. 1991.

Delgado, Christopher and Rebecca Lent, *Coastal Demand Constraints for Sahelian Livestock Products: Cote d'Ivoire,* Paper presented at the IFPRI/ISRA Seminar on Regional Integration of Agricultural Markets in West Africa, Saly Portudal, Senegal, December 2-4, 1992.

Delgado, Christopher L. *Le système d'exploitation agricole des Peuls du sud de la Haute Volta: une nouvelle forme d'un ancien modèle d'intégration de l'élevage: étude de l'agriculture dans la savane de l'Afrique Occidentale,* African Rural Economy Paper No. 20, Department of Agricultural Economics, East Lansing: Michigan State University, 1979.

Diakite, Lamissa, Amélioration de la valeur ajoutée due à la transformation et à l'exportation des produits de l'élevage, Rapport Provisoire, Draft Component Report, *Prospects For Developing Malian Livestock Exports*, EAGER/Trade Project Study, AIRD , January 1997.

Diarra, N'Thio Alpha. "L'embouche et valeur ajoutee de l'embouche au Mali," Draft Component Report, *Prospects For Developing Malian Livestock Exports*, EAGER/Trade Project Study, AIRD. February, 1997.

Doumbia, Abou. "Analyse des Tendances et des Projections de l'Offre et de la Demande de Viande Rouge au Mali," Draft Component Report, Prospects For Developing Malian Livestock Exports, EAGER/Trade Project Study, AIRD. November, 1996.

Duewer , Lawrence A., and Kenneth E. Nelson. "Beefpacking and Processing Plants, Computer - Assisted Cost Analysis," Commodity Economics Division, Economics Research Service, USDA, Staff Report No. AGES 9115, 1991.

Ekboir, Javier, Lovell S. Jarvis, Daniel A. Sumner, and William R. Sutton, "Evaluation of the Impact on World Meat Mrakets of the Recognition of Argentina and Uruguay as Free of Foot-and-Mouth Disease, With Emphasis on Low Income Countries," Prepared for the Small Ruminant CRSP, University of California, Davis, September, 1996.

Grayzel, John A., "Cattle Raisers and Cattle Raising in The Doukoloma Forest Area, October, 1974-September 1975," Department of Anthropology, University of Oregon.

Harms, Larry. "ECIBEV Credit Activites, May 1975-April 1978," USAID Mali Livestock, circ. 1979.

Holtzman, J. and N. Kulibaba, *Livestock marketing and trade in the Mali/Burkina Faso - Côte d'Ivoire corridor: draft,* Prepared for USAID by the AMIS project, Bethesda: Abt, 1990.

Lauras, E. *Vers un éspace économique pour les animaux et leur produits en Afrique de l'Ouest*, Document de travail, Mission Française Régionale d'Appui au CILSS, août 1990.

Lowdermilk, Melanie. *The characteristics and determinants of food consumption of poor households in urban Mali,* Doctoral dissertation, Tufts University, The Fletcher School of Law and Diplomacy, Medford, MA. 1991.

MacIntire, John, Daniel Bourzat, and Prabhu Pingali. *Crop-livestock interaction in sub-Saharan Africa*" Washington, D.C. World Bank Regional and Sectoral Studies, 1992.

Maiga, Mouslim Abdoulaye and Abou Doumbia, "Etude sur L'Identification et L'Echantillonnage des Systemes de Production Animale au Mali," Report, Ministere du Developpement Rural et de L'Environnement, Republique du Mali, November, 1994.

Mali, Ministère du Plan. *Enquête budget consommation, 1988-89: analyse préliminaire.* Bamako, mars 1991.

McCoy, John H. and M.E. Sarhan, "Livestock and Meat Marketing," Van Nostrand Reinhold Company, 1988.

Metzel, Jeffrey, *Economic Issues for a Livestock Development Strategy in Mali*, Prepared for the Plan D'Action de Developpement de la Filiere Viande Rouge, Cambridge, MA, AIRD, April, 1995.

____________, *Workshop handbook for the study of economic comparative advantage and incentives in livestock production and trade in West Africa's central corridor*. Prepared by Associates for International Resources and Development for this study, December 5, 1992.

____________ and Andy Cook. *Economic Comparative Advantage and Incentives in Livestock Production and Trade in West Africa's Central Corridor,* Cambridge, MA, AIRD, October, 1993.

____________ and Lynn Salinger. *An Economic Appraisal of the Impact of Government Policies on*

Rangeland Livestock Systems of North Africa and the Middle East. Somerville, MA. AIRD, December 1989.

____________ , Louise Cord et al. *Evaluation de la politique de prix et d'incitation dans le secteur marocain de l'élevage*, Somerville, MA. AIRD, November 1989.

Radostits, O.M. and D. C. Blood, *Herd Health*, Philadelphia, PA. W.B. Saunders Co., 1985.

Republique du Mali, Arrété No 069 of 26 mai 1995. Circulaire des Douanes n 781 of 26 June 1995.

Republique du Mali, Annuaire de Statistique de Transport, Ministere de Traveaux Publique. 1994.

Rosegrant, Mark, Mercidita Sombilla, Roberta Gerpacio and Claudia Ringler, "Global Food Markets and US Exports in the Twenty-First Century," Paper prepared for the Illinois World Food and Sustainable Agriculture Program Conference, May 27, 1977.

Shapiro, Kenneth H. and Abou Doumbia. *Mali livestock markets and marketing*. Unpublished paper for the Mali Animal Productivity and Export Project (APEX), 1992.

Sidibé, Seydou et Henri Josserand. *Echanges de produits de l'élevage - problématique et contribution de plusieurs initiatives actuelles à l'intégration régionale*. Paper presented at the Conférence Internationale sur l'Intégration de l'Afrique de l'Ouest, Dakar, 11-15 janvier 1993, sponsored by IDRC/ECOWAS, janvier 1993.

Stryker, J. Dirck, "The Marketing of Mali Cattle," The Fletcher School of Law & Diplomacy, Tufts University, Medford, MA. October 15, 1975.

Swift, Jeremy (ed.) *Pastoral development in central Niger: report of the Niger Range and Livestock Project (USAID)*. Niamey, 1984.

Umali, Dina L., Gershon Feder, and Cornelis de Haan. *The between public and private sector activities in the delivery of livestock services*. World Bank Discussion Paper 163, Washington, D.C. The World Bank, 1992.

USAID/Bamako, "Mali Livestock I, Third Annual and Final Report.

USAID/Bamako, "Mali Livestock Sector II," Project Paper 688-0218, August 20, 1982.

Wagenaar,K.T., A. Diallo, and A. R. Sayers. *Productivity of transhumant Fulani cattle in the inner Niger Delta of Mali*. Addis Ababa: ILCA, December 1986.

Wilson, R.T., *Livestock production in central Mali: Long-term studies on cattle and small ruminants in the agropastoral system*, International Livestock Center for Africa, Addis Ababa, Ethiopia, December 1986.

Winrock International Institute for Agricultural Development. *Assessment of Animal Agriculture in Sub-Saharan Africa*. Morrilton, Arkansas, 1992.

World Bank. *Ghana Livestock Sector Review.* Working papers 1-14, Washington, D.C. The World Bank, 1991.

World Bank. *Mali: Livestock Subsector Review*. Africa Region, Sahelian Department, Agriculture Operations, October 1990.

World Bank. *Republic of Côte d'Ivoire: Review of the Livestock Sector.* World Bank Report no. 10756-1vc, June 25, 1992.

OTHER CONSULTED DOCUMENTS

Anteneh, A. "Trends in Sub-Saharan Africa's Livestock Industries." in D. L. Hawksworth Ed. *Advancing agricultural production in Africa*. Proceedings of the CAB conference, Arusha, February 1984.

Ariza-Niño, Edgar, Seydou Sidibé and John Erikson. *Economic analysis of the livestock sector in the Republic of Mali.* Prepared for U.S. Agency for International Development, USAID/Bamako, under Macroeconomics IQC contract no. PDC-0000-I-23-6135-00, Washington D.C. Robert R. Nathan Associates, June 1988.

Baffoe-Bonnie, J. *Statistical analysis of demand for beef in Ghana.* Dissertation at the Department of Agricultural Economy, University of Ghana, Legon, 1977.

Barry, M. B. *Impact des mesures d'ajustement structurel sur les systèmes de production et les échanges de produits animaux entre la Côte d'Ivoire et les pays Saheliens limotrophes*. Paper presented at the Séminaire CIRES-ACDI-LAVAL. Abidjan, 15-19 June, 1992.

BDPA-SCETAGRI. *Approvisionnement et relance des échanges communautaires en betail et viande des pays membres de la CEBV*. Prepared for CEBV/FAC. September 1991.

Bernadet, P. *Association agriculture-élevage en Afrique: les Peuls semi-transhumants de Côte d'Ivoire*. Paris, Edition L'Harmattan, 1984.

Burkina Faso, Ministère de l'Agriculture. *Étude prospective du sous-secteur élevage au Burkina Faso*. Prepared by IEMVT-CIRAD/SFC SEDES-CEGOS for Secrétariat d'Etat à l'Élevage, April, 1991.

Burkina Faso, Ministère de l'Agriculture et de l'Élevage. *Paramètres zootechniques des petits ruminants.* Service Statistique Agricole, January 1990.

Burkina Faso, Ministère de l'Agriculture et de l'Élevage. *Enquête nationale sur les effectifs du cheptel, Vol I. Résultats et Analyses*. February 1990.

Charray, J. et. al. *Les petits ruminants d'Afrique Centrale et d'Afrique de l'Ouest: synthèse des connaissances actuelles*. IEMVT, 1980.

Coopers and Lybrand. *Complèxe d'Exploitation Industrielle du Bétail.* February 1990.

Coste, J. et al. *Étude: "Politiques de commerce extérieur des produits d'origine animale en Afrique de l'Ouest et du Centre", rapport de synthèse*. Prepared by SOLAGRAL/IRAM for CEBV. March 15, 1993.

Côte d'Ivoire, Ministère de l'Agriculture et des Ressources Animales, Direction Générale des Ressources Animales and Direction et Contrôle des Grands Travaux. *Secteur élevage: bilan et programme à moyen terme.* November, 1991.

IEMVT/SEDES, Côte d'Ivoire, Ministère de la Production Animale. *Étude de l'utilisation rationnelle des sous-produits agro-industriels par l'élevage et l'aquaculture.* May 1989.

Côte d'Ivoire, Ministère de la Production Animale, Présidence de la République, Direction et Contrôle des Grands Travaux and Commission des Communautés Européennes. *Étude d'un système de protection du marché de la viande et d'un fond de développement de l'élevage (rapport provisoire).* Prepared by J. Sarniguet for SEDES, June 1988.

Coulibaly, A. and I. Traoré. *Étude des circuits de commercialisation du bétail, de la viande et des produits de l'élevage dans les pays du Sahel et des pays côtiers: Mali.* Prepared for CILSS/ CEBV, July 1991.

Diallo, S. "Étude d'un marché de bétail Sahélien, le marché de Fatoma: une chaîne de relations". *Les cahiers d'outre-mer* N°156, octobre-décembre 1986.

Disset, R. *Élevage ovine: la production ovine et caprine en Côte d'Ivoire*. Ministère de Developpement Rural, Cahier #24, February 1986.

Doutresoulle, G. *L'élevage au Soudan Français: son économie.* Alger: E. Imbert, 1952.

Forjoe, Francis Jude. *The effect of price consumption on the demand for beef and fish in Ghana*. Dissertation at the Department of Agricultural Economy, University of Ghana, Legon, 1991.

Ghana, Ministry of Agriculture. *Ghana Medium Term Agricultural Development Program: an Agenda for Sustained Agricultural Growth and Development (1991-2000).* Prepared in collaboration with the Agriculture Operations Division, West Africa Department, Africa Region, The World Bank, February 9, 1990.

Gosi, Mariano, Oumar Ba, and Boucoum Kolado. *Étude des circuits de commercialsiation du bétail de la viande et de produits de l'élevage des pays du Sahel et des pays côtiers: rapport de synthese.* Ouagadougou: CILSS/CEBV, February 1992.

Gouet, G. *Étude de l'élevage dans le développement des zones cotonnières (Burkina Faso, Côte-d'Ivoire, Mali).* IEMVT/CCCE, January 1988.

Josserand, Henri. *A study of Demand for Animal Protein in Selected Coastal Countries: the Case of Ghana*. OECD/CILSS, July 1991.

Josserand, Henri. *Facteurs de contraintes sur l'offre de produits de l'élevage dans le "couloir central": (promotion des échanges à travers la réduction des coûts de commercialisation).* Paper presented at the Conférence sur l'intégration des marchés agricoles en Afrique de l'Ouest: enjeux pour les pays Sahéliens et leurs partenaires commerciaux, sponsored by IFPRI/ISRA, Saly Portudal, 2-4 December 1992.

Kodjo, Véronique. *Suivi statistique du cheptel bovin: performances zoötechniques*. Ministère de la Production Animale, Côte d'Ivoire, October 1990.

Kouassi, Bernard. "Analyse multidimensionnelle de la consommation urbaine de boeuf en Côte d'Ivoire". *Cahiers du CIRES* #1, 1991.

Mayer, J. F. *Le troupeau bovin du Burkina Faso: résultats d'enquêtes*. Institute d'Élevage et de Medicine Veterinaires des Pays Tropicaux, Ministère de l'Agriculture et de l'Élevage, Burkina Faso, November 1989.

McClintock, John. *Factors affecting output levels from African livestock sectors: an analysis of available data*. Addis Ababa:ILCA, 1984.

Melleville, P., J. Combes and J. Marchal. *Systèmes d'élevage Saheliens de l'Oudalan étude de cas*. ORSTOM, September 1982.

Pearson, Scott R., J. Dirck Stryker, and Charles P. Humphreys et al. *Rice in West Africa: policy and economics.* Stanford: Stanford University Press, 1981.

Sarniguet, Jean. *Effets des importations de viandes du marché mondial sur les échanges de bovins de la région Afrique de l'Ouest et Centrale - 1970/87*. Mimeograph, octobre 1989.

Shapiro, Kenneth H. *Assessment of animal agriculture in Africa.* Unpublished paper for Winrock International's Assessment of Animal Agriculture in Africa, March 1991.

University of Michigan. *La commercialisation du bétail et de la viande en Afrique de l'Ouest*. 1980.

ANNEX A
BACKGROUND TABLES FOR THE ANALYSIS OF SUPPLY AND DEMAND PROJECTIONS

Table A.1 HYPOTHESES DE CONSOMMATION ET DES ELASTICITES DE CONSOMMATION PAR RAPPORT AU REVENU
ASSUMPTIONS OF CONSUMPTION LEVELS AND INCOME ELASTICITIES

			Beef & Veal	Sheep & Goat	Offal & fat	Pork	Poultry	Milk
CONSOMMATION PAR CAPITA								
	RURAL	kg/capita/an	5.4	3.8	2.3	2.2	2.9	16.7
	URBAN	kg/capita/an	8.0	4.7	3.0	0.5	4.8	7.6
INCOME ELASTICITIES OF DEMAND								
	RURAL		1.00	1.00	0.60	0.90	1.42	1.20
	URBAN		0.80	0.80	0.50	0.70	1.42	1.20
Note:	1.	Bov*0.25+sr*0.15+porc*0.1+poultry*0.05						
	2.							

HYPOTHESES DEMOGRAPHIQUE	Niveau	taux de croissance annuel	HYPOTHESES DE REVENU		
DEMOGRAPHIC ASSUMPTIONS	Level	annual growth rate	INCOME ASSUMPTIONS		
Annee/year	1990	1990	Base yr:	1990	
TOTAL	8129569	2.4%			
RURAL	6207088	1.5%	RURAL per capita		
URBAN	1922481	5.3%	URBAN per capita		

Table A.2 HYPOTHESES D'EFFET DE LA DEMANDE DE VIANDE ROUGE ET BLANCHES PAR RAPPORT AUX PRIX

ELASTICITES	total	par annee	total
Elasticite de demande par rapport au prix viande rouge	-1.17		
% changement de prix mondiale	0.268852	2.41%	0.268
% changement de demande	-0.314557	-3.71%	0.045
Elasticite de demande par rapport au prix relatif de v. blanche	0.690		-
% changement de prix relatif (p.vd blanche/p.vd rouge)	-46.4%	-6.04%	-46
% changement de demande	-32.0%	-3.78%	53.
Effet total sur la demande		-7.49%	

Hypotheses des changements de prix		PRIX VIANDE		Demande po
		rouge	blanche	V. bovine
Period de transition:	2000	1200	1429	57
	2010	1523	973	39

Table A.3 PROPORTION DU TROUPEAU DE CHAQUE SYSTEM PAR REGION (base 1965)

SYSTEME	1	2	3	4	5	6
gao	59.94%	0.00%	0.00%	0.00%	0.00%	0.00%
tomboctou	40.06%	0.00%	38.63%	0.00%	0.00%	0.00%
mopti	0.00%	38.78%	55.52%	18.29%	0.00%	0.00%
kayes	0.00%	40.44%	5.85%	10.05%	0.00%	20.82%
koulikoro	0.00%	20.78%	0.00%	41.01%	0.00%	16.72%
segou	0.00%	0.00%	0.00%	30.65%	100.00%	0.00%
sikasso	0.00%	0.00%	0.00%	0.00%	0.00%	62.46%

Table A.4 STRUCUTRE DES TROUPEAUX PAR SYSTEM

SYSTEME	1	2	3	4	5	6
Taille	40.60	46.07	40.92	57.92	81.00	58.12
males entiers	0.28	0.26	0.26	0.26	0.29	0.27
femelles	0.67	0.65	0.67	0.62	0.59	0.62
males castres	0.05	0.10	0.07	0.12	0.12	0.11
Nombre f/treau	11.00	9.98	11.32	9.35	5.00	8.46
1ere vellage	55.00	58.36	52.75	60.72	63.00	62.58
taux fecondite	0.61	0.65	0.65	0.65	0.64	0.64
intervalle /2 vellage	19.92	18.13	18.39	18.25	18.70	18.59
<1 an	17.6%	17.9%	16.7%	16.8%	14.0%	17.5%
>1 an +	9.5%	9.4%	9.9%	8.3%	7.4%	6.6%
Taux de perte zootech	9.7%	11.0%	11.0%	9.5%	8.0%	7.4%
Taux d'exploitation brut	9.4%	9.0%	9.4%	7.9%	6.6%	7.2%
Taux d'introducton	3.5%	2.6%	3.5%	2.1%	2.0%	2.5%
Taux d'exploitation net	5.9%	6.4%	6.0%	5.8%	4.6%	4.6%
Taux croix brut	-0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
TAUX REND NUM	4.9%	8.2%	9.1%	7.7%	5.1%	7.2%
AGE A LA VENTE						
male	4	4	4	4	4	5
femelle	10	10	10	10	10	8

Table A.5 PARAMETRES DEMOGRAPHIQUES

SYSTEME	1	2	3	4	5	6
DONNES BIO-ECONOMIQUE						
STRUCTURE DU TROUPEAU						
Nombre initial dans le troupeau	100	100	100	100	100	100
% femelles	67.0	64.9	66.8	62.4	59.0	61.9
% reproductrices	38.57	36.34	39.09	36.52	36.60	38.33
AGE A LA VENTE						
male	4	4	4	4	4	5
femelle	10	10	10	10	10	8
TAUX DE MORTALITE						
jeunes	17.6%	17.9%	16.7%	16.8%	14.0%	17.5%
adults	9.5%	9.4%	9.9%	8.3%	7.4%	6.6%
REPRODUCTION						
Age primier mis-bas (mois)	55	58	53	61	63	63
Taux de fecondite	60.6%	65.2%	65.4%	65.1%	64.0%	63.9%
CHANGEMENTS DEMOGRAPHIQUE DU TROUPEAU						
Nombre des nouveau nes vivants	23.38	23.70	25.56	23.78	23.42	24.50
Mortalites pendant l'annee						
jeunes	4.12	4.24	4.28	3.98	3.28	4.30
adults	7.29	7.19	7.35	6.35	5.67	4.96
Taux d'exploitation net						
males	7.13	7.23	7.79	7.62	8.00	7.70
femellles	3.91	3.99	4.17	4.53	5.04	6.28
Total	11.05	11.22	11.96	12.15	13.04	13.98
Nombre a la fin de l'annee	100.92	101.05	101.97	101.30	101.44	101.27
Taux de croit net	0.92%	1.05%	1.97%	1.30%	1.44%	1.27%

Table A.6 PARAMETRES DE RENDEMENT / YIELD PARAMETERS

	Yield growth rate (%)	Stock growth rate (%)	Offtake rate	% offal	Kg/tete	Carcass yield kg/ head in herd
SYSTEMES BOVINS				0.25		
Pastoral Pur	0.0%	0.00%	0.11		118.2	13.06
Past./ Cult. Pluv.	0.0%	0.00%	0.11		152.4	17.11
Past./ Cult. Decru	0.0%	0.00%	0.12		118.2	14.14
Agro-past./ Cult. pluv.	0.0%	1.48%	0.12		130.7	15.88
Agro-past./ Cult. irrig.	0.0%	0.95%	0.13		116.8	15.23
Agro-past./ Cult. rente	0.0%	3.91%	0.14		112.3	15.70
SYSTEMES OVINS/CAPRINS		Small ruminants		0.15		
Pastoral Pur	0.0%	0.00%	0.3655		11.43	4.18
Past./ Cult. Pluv.	0.0%	0.00%	0.3655		12.96	4.74
Past./ Cult. Decru	0.0%	0.00%	0.3655		12.6	4.61
Agro-past./ Cult. pluv.	0.0%	3.21%	0.3655		12.9	4.71
Agro-past./ Cult. irrig.	0.0%	0.00%	0.3655		10.83	3.96
Agro-past./ Cult. rente	0.0%	4.25%	0.3655		12.07	4.41
AUTRES PRODUITS DE L'ELEVAGE						
Porc/Pork	0.0%		0.79	0.1	40	18.96
Poulet/Poultry	0.0%		1.10	0.05	1.3	1.144
Lait/Milk	0.0%		0.37	repro females in herd	266	49
Oeufs/Eggs			1.00		1	1
Poisson/Fish			1.00		1	1
5eme Quartier/Offal and animal fat#			1		1	0.3

ANNEX B

BACKGROUND TABLES FOR THE ANALYSIS OF LIVESTOCK FATTENING

Table B. 1 **Budget de l'embouche: Sommaire Financiere Detaille**
Fattening budget: Detailed Financial Summary

(FCFA/ HEAD/ FATTENING DAY)

		TROUPEAUX BOVINS			TROUPEAUX BOVINS		
		ECHANTILLON TOTAL	***TROUPEAUX SEMI INDUSTRIELS***	***TROUPEAUX PAYSANS***	***ECHANTILLON TOTAL***	***Grande troupeaux (>9)***	***Petit troupeaux (<10)***
Caracteristique de l'embouche(voir Calcul marge nette)							
Durée moyen d'engraissement:	**jours**	57.9	68.0	49.3	56.3	55.7	57.0
Taille du troupeau d'engraissement:	**tete**	8.4	14.0	3.6	6.7	12.0	1.3
Nombre de troupeaux		13	6	7	6	3	3
Unite de engraissement (ponderee)	**tete-jours**	7536	6219	1317	2243	2011	232
I. DEPENSES	***unité***						
A . SANTE							
Vaccin péripneumonie		0.08	0.00	0.47	0.0	0.0	0.0
Vaccin charbon symptomatique		0.04	0.00	0.24	0.0	0.0	0.0
Pasteurellose		0.04	0.00	0.24	0.1	0.0	0.5
Déparasitage interne		76.17	88.54	17.81	3.8	3.2	8.6
Déparasitageexterne		0.00	0.00	0.00	4.4	4.9	0.0
Trypanocide		81.82	92.50	31.40	5.1	4.9	6.5
Traitement vitaminique		0.08	0.00	0.46	0.0	0.0	0.0
Autres		4.58	5.55	0.00	0.1	0.1	0.0
Sous total		162.82	186.58	50.62	13.4	13.2	15.6

Table B. 1 cont.

Budget de l'embouche: Sommaire Financiere Detaille
Fattening budget: Detailed Financial Summary

	TROUPEAUX BOVINS			TROUPEAUX BOVINS		
	ECHANTILLON TOTAL	*TROUPEAUX SEMI INDUSTRIELS*	*TROUPEAUX PAYSANS*	*ECHANTILLON TOTAL*	*Grande troupeaux (>9)*	*Petit troupeaux (<10)*
B . ALIMENTATION						
ALIMENT S AGRO-INDUSTRIELS						
Aliment de betail prix CMDT	18.51	1.81	97.36	23.0	25.7	0.0
Aliment de betail prix HUICOMA	1.16	1.41	0.00	0.0	0.0	0.0
Aliment de betail prix Marché	128.00	145.46	45.56	1.0	0.1	8.6
Tourteau	10.78	13.06	0.00	0.0	0.0	0.0
Aliment de betail Hachkar	0.00	0.00	0.00	0.0	0.0	0.0
Son	11.99	14.15	1.78	0.0	0.0	0.0
Melasse	10.64	11.18	8.14	0.0	0.0	0.0
RESIDUTS DE CULTURES						
Tige de céréale	33.49	17.29	109.98	1.2	1.3	0.5
Epis de sorgho	0.00	0.00	0.00	0.0	0.0	0.0
Paille de riz	1.89	1.61	3.23	0.0	0.0	0.0
Fanes d'arachide/niébé	10.41	6.95	26.77	9.5	8.3	19.3
Paille de brousse	11.46	11.10	13.21	0.9	1.0	0.1
CULTURES FOURRAGERES						
Niébé	6.54	0.80	33.62	3.6	4.0	0.0
Autres	8.57	8.07	10.90	8.4	7.0	21.1
Autres	0.93	0.32	3.80	0.0	0.0	0.3
Sous total	254.37	233.20	354.34	47.6	47.4	49.9

Table B. 1 cont.

Budget de l'embouche: Sommaire Financiere Detaille
Fattening budget: Detailed Financial Summary

	TROUPEAUX BOVINS			TROUPEAUX BOVINS		
	ECHANTILLON TOTAL	*TROUPEAUX SEMI INDUSTRIELS*	*TROUPEAUX PAYSANS*	*ECHANTILLON TOTAL*	*Grande troupeaux (>9)*	*Petit troupeaux (<10)*
C.MAIN D'OEUVRE						
Calcul du temps de travail par jrs	0.00	0.00	0.00	0.0	0.0	0.0
Propriétaire	0.00	0.00	0.00	0.0	0.0	0.0
Femme	0.00	0.00	0.00	0.0	0.0	0.0
Garçon	0.00	0.00	0.00	0.0	0.0	0.0
Fille	0.00	0.00	0.00	0.0	0.0	0.0
Manoeuvre ou berger	0.00	0.00	0.00	0.0	0.0	0.0
a) Sous total: Minute /jour	0.00	0.00	0.00	0.0	0.0	0.0
Salaire estime	2.70	0.20	14.50	11.7	12.1	8.3
Salaires forfaitaire	34.25	41.51	0.00	0.0	0.0	0.0
Sous total	36.95	41.71	14.50	11.7	12.1	8.3
D. IMMOBILISATIONS						
	0.00	0.00	0.00	0.0	0.0	0.0
HABITAT DES ANIMAUX	0.00	0.00	0.00	0.0	0.0	0.0
Hangar/parc abri	35.10	37.93	21.74	1.8	1.3	6.6
autre Parc-enclo	71.05	86.10	0.00	0.0	0.0	0.0
autre	0.00	0.00	0.00	0.0	0.0	0.0
AUTRE IMMOBILISATION	0.00	0.00	0.00	0.0	0.0	0.0
puits traditionnel	1.30	0.06	7.15	1.5	1.1	4.9
Charette	5.28	0.00	30.23	2.4	2.7	0.0
autre	0.00	0.00	0.00	0.0	0.0	0.0
sous total	112.74	124.09	59.12	5.8	5.1	11.6

Table B. 1 cont.

Budget de l'embouche: Sommaire Financiere Detaille
Fattening budget: Detailed Financial Summary

	TROUPEAUX BOVINS			TROUPEAUX BOVINS		
	ECHANTILLON TOTAL	*TROUPEAUX SEMI INDUSTRIELS*	*TROUPEAUX PAYSANS*	*ECHANTILLON TOTAL*	*Grande troupeaux (>9)*	*Petit troupeaux (<10)*
E. FRAIS FINAN.DU CAPIT.						
interêt/prêt achat animaux	36.76	37.40	33.75	6.2	5.5	12.4
inter^t/frais de charge	5.03	5.24	4.01	1.9	1.7	3.1
(post santé,aliment,m.d'oe	1.15	1.11	1.31	0.0	0.0	0.0
Sous total	42.94	43.76	39.07	8.1	7.2	15.5
DEPENSES TOTALES	609.82	629.34	517.64	86.6	85.0	100.9
II. BENEFICE						
A.MARGE BRUTE						
Troupeau embouche	1228.69	1096.32	1853.77	357.4	362.5	312.9
fumure	101.98	69.14	257.02	34.2	35.2	25.4
autre	0.00	0.00	0.00	0.0	0.0	0.0
BENEFICE TOTAL	1330.67	1165.46	2110.80	391.6	397.8	338.3
BENEFICE NET FINANCIER	720.85	536.12	1593.16	305.0	312.8	237.4

ANNEX C
BACKGROUND TABLES FOR THE ANALYSIS OF LIVESTOCK AND MEAT MARKETING

Table C.1 **Hypotheses de commercialisation**
Marketing Hypotheses

		Animaux sur pied ***Live animals***		***Viande rouge carcasse*** ***Red meat carcass***		***Viande rouge coupe/carton*** ***Red meat, cut/boxed***	
Poids vifs (kg)			250		250		250
Rendement de l'abattage (%)			50.0%		50.0%		30.9%
Poids carcasse (kg)			125		125		77
Taux de perte en route (%)			1.0%		3.0%		2.0%
Taux utilis. transport (%)			100.0%		75.0%		75.0%
Prix d'achat (Bamako, tete)		960	120000	950	118750	1266	97707
Prix de vente (Abidjan, tete)	CFA	1320	165000	1250	164253	1351	104264
Prix de vente (Dakar, tete)	CFA	1280	160000	1150	143750	1243	95923
Prix de vente (Ghana, tete)	Cidi	3,601	450092	3467	433333	3746	289159
	CFA	1385	173112	1333	166667	1441	111215
Prix de vente (Monde /FMD, tete)	na			1180	147500	2652	204677

Notes

Taux d'intêret	annuel	10%	journalier	0.03%
Taux de change: CFA/$	500.0			
Taux de change: Cidi/$	1300.0			
Taux de change: Cidi/CFA	2.6			

Table C.2

COMPARISON OF EXPORT COSTS FOR LIVE ANIMALS AND RED MEAT

(FCFA/Kg carcass meat)

	Live animal				*Carcass red meat*			*Cut & boxed meat*		
	financial costs	*official taxes*	*illicit taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*
Sale in Abidjan										
Mali										
Slaughter cost	0	0	0	0	41	2	39	112	0	112
Byproduct value	0	0	0	0	-104	34	-138	-684	54	-739
Export costs	109	7	6	96	168	12	156	168	12	156
Total in Mali	109	7	6	96	105	47	58	-404	66	-470
Cote d'Ivoire										
Transport to Coastal Market	90	8	14	67	258	155	103	258	155	103
Slaughter cost	91	8	0	83	0	0	0	0	0	0
Byproduct value	-203	-2	0	-201	0	0	0	0	0	0
Total in coastal market	-22	14	14	-51	258	155	103	258	155	103
Total transaction cost	**87**	**21**	**21**	**45**	**363**	**202**	**160**	**-146**	**221**	**-367**
Sale in Dakar										
Mali										
Slaughter cost	0	0	0	0	41	2	39	112	0	112
Byproduct value	0	0	0	0	-104	34	-138	-684	54	-739
Export costs	99	17	2	80	100	-200	300	100	-200	300
Total in Mali	99	17	2	80	37	-164	201	-472	-145	-326
Senegal										
Transport to Coastal Market	134	20	2	112	208	19	188	208	19	188
Slaughter cost	91	8	0	83	0	0	0	0	0	0
Byproduct value	-203	-2	0	-201	0	0	0	0	0	0
Total in coastal market	22	26	2	-6	208	19	188	208	19	188
Total transaction cost	**121**	**43**	**4**	**74**	**245**	**-145**	**390**	**-264**	**-126**	**-138**

Table C.2 cont.

COMPARISON OF EXPORT COSTS FOR LIVE ANIMALS AND RED MEAT
(FCFA/Kg carcass meat)

	Live animal				*Carcass red meat*			*Cut & boxed meat*		
	financial costs	*official taxes*	*illicit taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*	*financial costs*	*official taxes*	*economic costs*
Sales in Accra										
Mali										
Slaughter cost	0	0	0	0	41	2	39	112	0	112
Byproduct value	0	0	0	0	-104	34	-138	-684	54	-739
Export costs	40	3	2	35	193	14	180	193	14	180
Total in Mali	40	3	2	35	**130**	**49**	**81**	**-379**	**68**	**-447**
Ghana										
Transport to Coastal Market	124	20	9	96	320	155	165	320	155	165
Slaughter cost	25	6	0	19	0	0	0	0	0	0
Byproduct value	-203	-2	0	-201	0	0	0	0	0	0
Total in coastal market	-53	24	9	-86	**320**	**155**	**165**	**320**	**155**	**165**
Total transaction cost	**-13**	**27**	**11**	**-51**	**450**	**204**	**246**	**-59**	**223**	**-282**
Sale to World market										
Mali										
Slaughter cost		**NA**			41	2	39	112	0	112
Byproduct value					-104	34	-138	-684	54	-739
Export costs					1109	78	1031	1109	78	1031
Total in Mali					**1046**	**113**	**933**	**537**	**132**	**405**
Importing market (Middle East)										
Transport		**NA**			218	90	129	218	90	129
Slaughter cost					0	0	0	0	0	0
Byproduct value					0	0	0	0	0	0
Total in coastal market					**218**	**90**	**129**	**218**	**90**	**129**

Total transaction cost	**NA**	**1264**	**203**	**1062**	**755**	**222**	**534**

Table C. 3 **Budget de Transport de la Viande Rouge : BAMAKO - ABIDJAN**

Type de transport :	Camion frigorifique		
Produit :	Viande bovine	Unité d'analyse :	chargement
Origine :	Bamako	Kg potentiels/unité:	10000
Poste frontalier :	Zegoua	Nombre tete /unité :	80
Destination final :	Abidjan	Taux utilis. transport :	75%

	Unités	Quantité	Prix unitaire	Coût financier	Taxes officielles	Taxes sauvages	Cout financier NET	Taxes indirects		COUT ECONOMI QUE	Echangea bles	Nonec geabl
		a	b	c = a*b	d	e	Hors taxes direct	echang.	nonechang			m'd O
CHARGES DE TRANSPORT												
Mali												
Frais transport Bamako - Zegoua	FCFA/camion	1.00	462988	462988	0	0	462988	27661	1588	433739	323114	7
Réfrigération avant l'envoi	FCFA/camion	10000.00	25	250000	0	0	250000	16354	1146	232500	152312	5
Chargement	FCFA/camion	1.00	3750	3750	0	0	3750	0	563	3188	375	
Inspection Zootechnique/Scellage	FCFA/camion	9600000.00	0.50%	48000	0	0	48000	0	7200	40800	4800	3
Coût du capital marchandise	FCFA/camion	9600000.00	0.39%	37676	0	0	37676	0	3768	33908	0	
Taxes/Impôts Officiels	FCFA/camion	0.00	0	0	0	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/camion	0.37%	9600000	35200	0	35200	0	0	0	0	0	
Pertes	FCFA/camion	1.5%	9600000	144000	0	0	144000	0	0	144000	144000	
Charges Bamako a la Frontiere	FCFA			981614	0	35200	946414	44015	14264	888135	624601	16
/Kg	FCFA/Kg	7500.00		131	0	5	126	6	2	118	83	
Cote d'Ivoire												
Frais transport Zegoua -Abidjan	FCFA/camion	1.00	382013	382013	0	0	382013	0	0	382013	15926	36
Déchargement	FCFA/camion	1.00	3750	3750			3750	0	563	3188	375	
Réfrigération à l'arrivée	FCFA/camion	10000	25	250000			250000	16354	1146	232500	152312	5
Taxes/Impôts	FCFA/camion	10000.00	80	800000	800000	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/camion	0.17%	105600	176	0	176	0	0	0	0	0	
Inspection Zootechnique	FCFA/camion	1.00	10000	10000	0	0	10000	0	1500	8500	1000	
Pertes	FCFA/camion	1.5%	105600	1584	0	0	1584	0	0	1584	1584	

Coût du capital de commerce	FCFA/camion	2391461.00	0.05%	1249			1249	0	125	1124	0	
Charges Frontiere a Abidjan	FCFA			1448772	800000	176	648596	16354	3333	628909	171197	42
/Kg	FCFA/Kg carcass	7500.00		193	107	0	86	2	0	84	23	
Charge Total Bamako-Abidjan	FCFA			2430386	800000	35376	1595010	60369	17597	1517044	795798	59
/Kg	FCFA/Kg carcass			324	107	5	213	8	2	202	106	
BENEFICE												
Prix d'achat du Kg : Bamako	FCFA/Kg carcass	1.00	960	960	0	0	960					
Prix de vente du Kg : Abidjan	FCFA/Kg carcass	1.00	11	11	0	0	11					
Marge brut Bamako-Abidjan	FCFA/Kg carcass			-949	0	0	-949					
BENEFICE NET Bamako-Abidjan	FCFA/Kg			-1273	-107	-5	-1162					

Table C.4 **Budget de Transport de la Viande Rouge: BAMAKO - DAKAR**

Type de transport :	Containeur Frigo		
Produit :	Viande bovine	Unité d'analyse :	wagon
Origine :	Bamako	Kg/unite:	33333
Poste frontalier :	Diboly	Nombre tete /unité :	267
Destination finale :	Dakar	Taux utilis. transport	75.0%

	Unités	Quantité	Prix unitaire	Coût financier	Taxes officielles	Taxes sauvages	Cout financier NET	Taxes indirects		COUT ECONOMIQUE	Echangeables	Nonec geable
		a	b	c = a*b	d	e	Hors taxes direct	echang.	nonechang			m'd O
CHARGES DE TRANSPORT												
Mali												
Frais transport Bamako-Diboly	FCFA/Wagon	1.00	635930	635930	0	0	635930	37994	2181	595755	443808	9
Réfrigération avant l'envoi	FCFA/Wagon	33333.00	25	833325	0	0	833325	54512	3819	774994	507703	18
Chargement	FCFA/Wagon	1.00	3750	3750	0	0	3750	0	563	3188	375	
Inspection Zootechnique/Scellage	FCFA/Wagon	255997.44	0.50%	1280	0	0	1280	0	192	1088	128	
Coût du capital marchandise	FCFA/Wagon	255997.44	0.39%	1005	0	0	1005	0	100	904	0	
Taxes/Impôts Officiels	FCFA/Wagon	0.00	0	0	0	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/Wagon	0.10%	31999680	32000	0	32000	0	0	0	0	0	
Pertes	FCFA/Wagon	1.5%	31999680	479995	0	0	479995	0	0	479995	479995	
Charges Bamako a la Frontiere	FCFA			1987285	0	32000	1955285	92506	6855	1855924	1432008	29
/Kg	FCFA/Kg	24999.75		79	0	4	261	12	1	247	191	
Sénégal												
Frais transport Diboly- Dakar	FCFA/Wagon	1.00	382013	382013	0	0	382013	0	0	382013	15926	36
Déchargement	FCFA/Wagon	1.00	3750	3750			3750	0	563	3188	375	
Réfrigération à l'arrivée	FCFA/Wagon	33333	25	833325			833325	54512	3819	774994	507703	18
Taxes/Impôts	FCFA/Wagon	33333.00	80	2666640	2666640	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/Wagon	0.10%	351996	352	0	352	0	0	0	0	0	
Inspection Zootechnique	FCFA/Wagon	0.00	10000	0	0	0	0	0	0	0	0	
Pertes	FCFA/Wagon	1.5%	351996	5280	0	0	5280	0	0	5280	5280	

Coût du capital de commerce	FCFA/Wagon	5877639.81	0.05%	3070			3070	0	307	2763	0	
Charges Frontiere a Dakar	FCFA			3894430	2666640	352	1227438	54512	4689	1168237	529284	55
/Kg	FCFA/Kg carc.	24999.75		156	356	0	164	7	1	156	71	
Charge Total Bamako-Dakar	FCFA			5881715	2666640	32352	3182723	147018	11544	3024161	1961292	84
/Kg	FCFA/Kg carcass			235	356	4	424	20	2	403	262	
BENEFICE												
Prix d'achat du Kg : Bamako	FCFA/Kg carcass	1.00	960	960	0	0	960					
Prix de vente du Kg : Dakar	FCFA/Kg carcass	1.00	11	11	0	0	11					
Marge brut Bamako-Dakar	FCFA/Kg carcass			-949	0	0	-949					
BENEFICE NET Bamako-Dakar	FCFA/Kg			-1185	-356	-4	-1374					

Table C.5 **Budget de Transport de la Viande Rouge: BAMAKO - ACCRA**

Type de transport :	Camion frigorifique		
Produit :	Viande bovine	Unité d'analyse :	chargement
Origine :	Bamako	Kg potentiels/unité:	10000
Poste frontalier :	Ouaga	Nombre tete /unité :	80
Destination final :	Accra	Taux utilis Transport	75%

	Unités	Quantité	Prix unitaire	Coût financier	Taxes officielles	Taxes sauvages	Cout financier NET	Taxes indirects		COUT ECONOMIQUE	Echangeables	Nonec geable
CHARGES DE TRANSPORT												
Mali												
Frais transport Bamako - Ouaga	FCFA/camion	1.00	584376	584376	0	0	584376	34913	2004	547458	407829	9
Réfrigération avant l'envoi	FCFA/camion	10000.00	25	250000	0	0	250000	16354	1146	232500	152312	5
Chargement	FCFA/camion	1.00	3750	3750	0	0	3750	0	563	3188	375	[illegible]
Inspection Zootechnique/Scellage	FCFA/camion	9600000.00	0.50%	48000	0	0	48000	0	7200	40800	4800	3
Coût du capital marchandise	FCFA/camion	9600000.00	0.39%	37676	0	0	37676	0	3768	33908	0	
Taxes/Impôts Officiels	FCFA/camion	1.00	18600	18600	0	0	18600	18600	0	0	0	
Taxes/Impôts Sauvages	FCFA/camion	0.37%	9600000	35200	0	35200	0	0	0	0	0	
Pertes	FCFA/camion	1.5%	9600000	144000	0	0	144000	0	0	144000	144000	
Charges Bamako a la Frontiere	FCFA			1121602	0	35200	1086402	69867	14680	1001854	709316	18
/Kg	FCFA/Kg	7500.00		150	0	5	145	9	2	134	95	
Accra												
Frais transport Ouaga-Accra	FCFA/camion	1.00	731251	731251	0	0	731251	0	0	731251	30486	69
Déchargement	FCFA/camion	1.00	3750	3750			3750	0	563	3188	375	[illegible]
Réfrigération à l'arrivée	FCFA/camion	10000	25	250000			250000	16354	1146	232500	152312	5
Taxes/Impôts	FCFA/camion	10000.00	80	800000	800000	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/camion	0.17%	105600	176	0	176	0	0	0	0	0	
Inspection Zootechnique	FCFA/camion	1.00	10000	10000	0	0	10000	0	1500	8500	1000	[illegible]
Pertes	FCFA/camion	1.5%	105600	1584	0	0	1584	0	0	1584	1584	
Coût du capital de commerce	FCFA/camion	2880687.00	0.05%	1505			1505	0	150	1354	0	
Charges Frontiere a Accra	FCFA			1798266	800000	176	998090	16354	3359	978377	185757	75
/Kg	FCFA/Kg	7500.00		240	107	0	133	2	0	130	25	

carcass

Charge Total Bamako-Accra	FCFA			2919867	800000	35376	2084491	86221	18039	1980231	895073	94
/Kg	FCFA/Kg carcass			389	107	5	278	11	2	264	119	
BENEFICE												
Prix d'achat du Kg : Bamako	FCFA/Kg carcass	1.00	960	960	0	0	960					
Prix de vente du Kg : Accra	FCFA/Kg carcass	1.00	11	11	0	0	11					
Marge brut Bamako-Accra	FCFA/Kg carcass			-949	0	0	-949					
BENEFICE NET Bamako-Accra	FCFA/Kg			-1339	-107	-5	-1227					

Table C.6 **Budget de Transport de la Viande RougeL: BAMAKO - SAUDI ARABIA**

Type de transport :	Air Cargo frigorifique		
Produit :	Viande bovine	Unité d'analyse :	chargement
Origine :	Bamako	Kg potentiels/unité:	30000
Poste frontalier :		Nombre tete /unité :	240
Destination final :	Arabie Saoud.	Taux utilis. transport	75%

	Unités	Quantité	Prix unitaire	Coût financier	Taxes officielles	Taxes sauvages	Cout financier NET	Taxes indirects		COUT ECONOMIQUE	Echangeables	Nonechangeables
CHARGES DE TRANSPORT												
Mali												
Frais transport Bamako-Arab.S.	FCFA/cargo	30000.00	560	16800000	0	0	16800000	1003713	57624	15738663	11724510	259
Réfrigération avant l'envoi	FCFA/cargo	30000.00	25	750000	0	0	750000	49062	3437	697501	456937	17
Frais transitaires	FCFA/cargo	1.00	23600	23600	0	0	23600	0	3540	20060	2360	1
InspectZootechnique/Scellage	FCFA/cargo	28800000.00	0.50%	144000	0	0	144000	0	21600	122400	14400	10
Coût du capital marchandise	FCFA/cargo	28800000.00	0.39%	113027	0	0	113027	0	11303	101724	0	
Taxes/Impôts Officiels	FCFA/cargo	30000.00	15	450000	0	0	450000	450000	0	0	0	
Taxes/Impôts Sauvages	FCFA/cargo	0.37%	28800000	105600	0	105600	0	0	0	0	0	
Pertes	FCFA/cargo	1.5%	28800000	432000	0	0	432000	0	0	432000	432000	
Charges Bamako a l'aéroport	FCFA			18818227	0	105600	18712627	1502775	97504	17112348	12630207	289
/Kg	FCFA/Kg	22500.00		836	0	14	2495	200	13	2282	1684	
Arabie Saoudite												
Frais transport Bamako-Arabie S	FCFA/cargo	1.00	0	0	0	0	0	0	0	0	0	
Déchargement	FCFA/cargo	1.00	3750	3750			3750	0	563	3188	375	
Réfrigération à l'arrivée	FCFA/cargo	30000	25	750000			750000	49062	3437	697501	456937	17
Taxes/Impôts	FCFA/cargo	30000.00	15	450000	450000	0	0	0	0	0	0	
Taxes/Impôts Sauvages	FCFA/cargo	0.17%	316800	528	0	528	0	0	0	0	0	
Inspection Zootech	FCFA/cargo	1.00	10000	10000	0	0	10000	0	1500	8500	1000	
Pertes	FCFA/cargo	1.5%	316800	4752	0	0	4752	0	0	4752	4752	
Coût du capital de commerce	FCFA/cargo	19924230.00	0.05%	10408			10408	0	1041	9367	0	
Charges Frontiere AS	FCFA			1229438	450000	528	778910	49062	6541	723308	463064	18
/Kg	FCFA/K	22500.00		164	60	0	104	7	1	96	62	

Charge Total Bamako-Arabie Saoudite	FCFA			20047665	450000	106128	19491537	1551836	104045	17835656	13093271	307
/Kg	FCFA/Kg carcass			1000	60	14	2599	207	14	2378	1746	
BENEFICE												
Prix d'achat du Kg : Bamako	FCFA/Kg carcass	1.00	960	960	0	0	960					
Prix de vente du Kg : Arabie Saoudite	FCFA/Kg carcass	1.00	11	11	0	0	11					
Marge brut Bamako-Arabie Saoudite	FCFA/Kg carcass			-949	0	0	-949					
BENEFICE NET Bamako-Arabie Saoudite	FCFA/Kg			-1950	-60	-14	-3548					

Table C.7 **Valeur Des Sous Produits De L'abattage**

		Quantite	Prix Unitaire	Cout Unitaire	Cout Financiere	Taxes Directes Ech.	Non-Ech.	Sauvages	Cout net Financiere	Taxes Indirectes Ech.	Non-Ech.	Echang-Cout Eonom.	Ecangeable
		A	B	C	D=A*B	E	F	G	H=A*C	I=H*P	I=H*Q	K=H-I-J	L=H*R
BAMAKO													
Carcass													
cuir/peau	CFA/kg	5	700	1540	3500	-4200	0	0	7700	0	0	7700	7700
tete	CFA/t•te	1	3000	3000	3000	0	0	0	3000	0	0	3000	3000
pates	CFA/t•te	4	500	500	2000	0	0	0	2000	0	0	2000	2000
abats	CFA/kg	3	1500	1500	4500	0	0	0	4500	0	0	4500	4500
	CFA/t•te	0	0	0	0	0	0	0	0	0	0	0	0
Total	CFA/t•te				13000	-4200	0	0	17200	0	0	17200	17200
	CFA/kg carcasse	125			104	-34	0	0	138	0	0	138	138
Transformation au niveau de coup/carton													
os	CFA/t•te	35.625	835	835	29763	0	0	0	29763	0	0	29763	29763
Vente dans la sous-region													
Total sous/produit	CFA/t•te				52808	-4200	0	0	57008	0	0	57008	57008
	CFA/kg carton	77.1875			684	-54	0	0	739	0	0	739	739
Vent au marche mondial													
Total sous/produit	CFA/t•te				83255	-4254	0	0	87510	0	0	87510	87510
	CFA/kg carton	97707.3475			1	0	0	0	1	0	0	1	1

Table C.7 cont.

Valeur des Sous Produits De L'abattage

		Quantite	Prix Unitaire	Cout Unitaire	Cout Financiere	Taxes Directes Ech.	Non-Ech.	Sauvages	Cout net Financiere	Taxes Indirectes Ech.	Non-Ech.	Echang- Cout Eonom.	Ecange able
		A	B	C	D=A*B	E	F	G	H=A*C	I=H*P	I=H*Q	K=H-I-J	L=H*R
ABIDJAN													
Carcasse													
tete	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
peau	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
pates	CFA/t•te	4	800	800	3200	0	0	0	3200	0	0	3200	3200
poche	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
foie	CFA/t•te	1	1000	917	1000	83	0	0	917	0	0	917	917
rognon	CFA/t•te	1	400	380	400	20	0	0	380	0	0	380	380
rate	CFA/t•te	1	400	369	400	31	0	0	369	0	0	369	369
langue	Cfa/tete	1	1000	970	1000	30	0	0	970	0	0	970	970
purmon	Cfa/tete	1	600	532	600	68	0	0	532	0	0	532	532
coeur	CFA/t•te	1	800	770	800	30	0	0	770	0	0	770	770
Autres abats	CFA/t•te	1	0	0	0	0	0	0	0	0	0	0	0
Total	CFA/t•te				28400	263	0	0	28137	0	0	28137	28137
	CFA/kg carcasse	140			203	2	0	0	201	0	0	201	201

Table C. 7 cont.

Valeur des Sous Produits De L'abattage

						Taxes Directes				Taxes Indirectes		Echang-	
		Quantite	Prix Unitaire	Cout Unitaire	Cout Financiere	Ech.	Non-Ech.	Sauvages	Cout net Financiere	Ech.	Non-Ech.	Cout Eonom.	Ecange able
		A	B	C	D=A*B	E	F	G	H=A*C	I=H*P	I=H*Q	K=H-I-J	L=H*R
Accra Carcasse													
cuir/peau	Cidi/kg	5	2500	2500	12500	0	0	0	12500	0	0	12500	12500
pieds	Cidi/tete	1	15000	15000	15000	0	0	0	15000	0	0	15000	0
tete	Cidi/tete	1	25000	25000	25000	0	0	0	25000	0	0	25000	0
cue	Cidi/tete	1.5	3500	3500	5250	0	0	0	5250	0	0	5250	0
abats	Cidi/tete	1	2000	2000	2000	0	0	0	2000	0	0	2000	0
organs	Cidi/kg	3	2600	2600	7800	0	0	0	7800	0	0	7800	0
--	Cidi/kg	1	0	0	0	0	0	0	0	0	0	0	0
Total	Cidi/tete				67550	0	0	0	67550	0	0	67550	12500
	Cidi/kg				483	0	0	0	483	0	0	483	89
	Taux de change	CFA/Cidi	0.385										
Total	CFA/t•te				25981	0	0	0	25981	0	0	25981	4808
	CFA/kg carcasse	140			186	0	0	0	186	0	0	186	34

Table C. 7
cont.

Valuer des Sous Produits De L'abattage

		Quantite	Prix Unitaire	Cout Unitaire	Cout Financiere	Taxes Directes Ech.	Non-Ech.	Sauvages	Cout net Financiere	Taxes Indirectes Ech.	Non-Ech.	Echang- Cout Eonom.	Ecange able
		A	B	C	D=A*B	E	F	G	H=A*C	I=H*P	I=H*Q	K=H-I-J	L=H*R
Dakar Carcasse													
tete	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
peau	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
pates	CFA/t•te	4	800	800	3200	0	0	0	3200	0	0	3200	3200
poche	CFA/t•te	1	7000	7000	7000	0	0	0	7000	0	0	7000	7000
foie	CFA/t•te	1	917	917	917	0	0	0	917	0	0	917	917
rognon	CFA/t•te	1	380	380	380	0	0	0	380	0	0	380	380
rate	CFA/t•te	1	369	369	369	0	0	0	369	0	0	369	369
langue	Cfa/tete	1	970	970	970	0	0	0	970	0	0	970	970
purmon	Cfa/tete	1	532	532	532	0	0	0	532	0	0	532	532
coeur	CFA/t•te	1	770	770	770	0	0	0	770	0	0	770	770
Autres abats	CFA/t•te	1	0	0	0	0	0	0	0	0	0	0	0
	CFA/kg carcasse	140			0	0	0	0	0	0	0	0	0